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SAFETY ELEMENT

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Adopted by City Council Resolution 95.047 on June 6, 1995

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History of Laguna Beach Lands and Public Safety Concerns

The Coastal and Public Safety Concern was first raised on February 22, 1976. There have not been any serious incidents in the history of the city's history. On October 27, 1976, a portion of the City of Laguna Beach was damaged by a fire. Immediately after the fire, the City launched its work program and directed the Community Development Department to update the General and Public Safety Plans. This was effected by January 1, 1977. During this work effort, the Planning Commission decided to merge the General and Public Safety Plans and expand its scope to cover fire, flooding, shoreline protection and the other issues as are required of local government.

Current Participation

The participation has been very good and a solid foundation in the planning process, particularly in reflecting community values, needs and goals. In the City of Laguna Beach, citizens participate in a particularly important manner in the local planning process, providing input to the community in a variety of ways. This participation has added value and visibility to planning studies and significant public understanding and support for such plans.

Community involvement played an important role in the development of the update to the City's Plan. The City Council directed the Planning Department to form a community committee to assist the City's Planning Department and any interested citizens of Laguna Beach in the development of the update to the Plan. The committee was formed in the summer of 1976 and has been active in the development of the update to the Plan. The committee has been very helpful in the development of the update to the Plan, and in providing the information and quality of community input and public.

INTRODUCTION

Legislative History and Authority

In 1971, the California State Legislature required that all cities and counties adopt Seismic and Safety Elements as part of their General Plans. The basic objective of the Safety Element is to reduce loss of life, injury, damage to property and economic and social dislocation resulting from future natural and manmade hazards. To achieve this objective, the Safety Element is utilized as the major tool for identifying hazards that should be considered before making land use decisions. Mapping is required of known seismic and other geologic hazards (such as landslide areas), and issues such as emergency evacuation routes and water supply for fire fighting must be addressed.

History of Laguna Beach Seismic and Public Safety Element

The Seismic and Public Safety Element was first adopted on February 28, 1979. There have not been any revisions to this Element since the original adoption. On October 27, 1993, portions of the City of Laguna Beach were devastated by a wildfire. Immediately after this fire storm, the City reevaluated its work program and directed the Community Development Department to update the Seismic and Public Safety Element. This work effort began in January of 1994. During this work effort, the Planning Commission decided to rename this element the Safety Element and expanded its scope to cover storm drainage, shoreline protection and the use, transport and disposal of hazardous materials.

Citizen Participation

Public participation has traditionally performed a valuable function in the planning process, particularly in reflecting community values, needs and goals. In the City of Laguna Beach, citizen participation has been a particularly important feature of the local planning process, providing residents an opportunity to express their thoughts and viewpoints and interact in the decision-making process. This participation in the community has added quality and credibility to planning studies and engenders public understanding and support for such plans.

Citizen involvement played an instrumental role in the development of this update to the Safety Element. The City Council directed the Planning Commission to invite the representatives from all of the City's Homeowner's Associations and any interested citizens of Laguna Beach to attend the numerous Safety Element update workshops. The ideas developed in these workshops were particularly valuable in the actual development of the Safety Element, and in determining the importance and priority of community goals and policies.

Organization of the Safety Element

The Safety Element is organized into six topics and an implementation chapter. Following the introduction, Topics 1 through 6 discuss separate safety issues as they relate to the City of Laguna Beach. Following the discussion in each topic is a series of policies to deal with the identified issues. The final section of the element indicates which City Department has primary responsibility for implementing each particular policy, how it will be funded and the scheduled timing for implementation.

TOPIC 1: EMERGENCY PLANNING/RESPONSE

The potential for a major calamity increases with the continuing urbanization of previously unpopulated areas and with the advent of industrial processes which utilize hazardous materials. The impact of earthquake, fire and flood is magnified as more and more high-risk land is urbanized. Because of their unknown or unexpected nature, many emergencies require quick and decisive action. Because disasters are dynamic and we continually learn through experience, emergency response and planning should also be dynamic and continually maintained and updated. Several disasters in Laguna Beach and in other communities in California have taught us a great deal about disaster response.

The City of Laguna Beach adopted an Emergency Services Plan in August of 1987. This Plan details the City's specific responsibilities before, during and after any emergency. This Plan is consistent with the State Emergency Services Plan, which describes the response of all levels of government and certain private sector organizations to natural, man-made or war-caused emergencies which threaten life, property and the resources of California. Section 8568 of the California Emergency Services Act provides a basis for the City's emergency management programs by requiring cities to carry out the provisions of the California Emergency Plan. The City's Plan is an extension of the State Plan.

The City's Plan describes how the City will respond in the event of, but not limited to, a state of war emergency, natural emergency situations (earthquakes, fires, floods, storms and tsunamis) and man-made emergency situations (pollution spills, civil disturbances, aircraft accidents, industrial accidents, explosions and radiological incidents). Emergencies that are preceded by a recognized buildup period allow for advance warning to those impacted areas and population groups. Timely warning and information broadcasts are important to the citizens' ability to help themselves and for their evacuation. Emergencies which occur without advance warning require prompt mobilization and commitment of the emergency organization after the onset of the emergency.

During or following local emergencies, the City is the first agency involved. If the emergency is so large that the City's resources are inadequate or are exhausted, assistance will be requested of, and provided by, nearby jurisdictions through mutual aid. Neighborhood groups can be of assistance to the City by conducting first aid and search and rescue operations in times of large disasters. When mutual aid systems are no longer sufficient for the disaster task, the County requests assistance from the State. The Governor's Office of Emergency Services (OES) coordinates regional emergency response and disaster assistance. The State may also request aid from the Federal government in the form of a Presidential Disaster Declaration. The Federal Emergency Management Agency (FEMA) then provides disaster assistance, temporary housing assistance and recovery funds after a Presidential Disaster Declaration.

The City's Emergency Services Plan lists three temporary seats of government in the event City Hall is not available. Due to the close proximity of all of these alternate locations, it is likely that in a major catastrophe such as a wildfire or earthquake, none of these facilities will be available. The locations of alternate seats of government and emergency facilities have not been evaluated as to their effectiveness in terms of location and response capabilities.

Mobility of the community to accomplish evacuation and the deployment of emergency personnel during any disaster is essential. A variety of emergency response challenges exist within the City of Laguna Beach. The City is located in hilly terrain, and many neighborhoods have narrow dead-end streets with only one means of access.

It is the City's responsibility to develop evacuation plans which will readily and effectively remove residents from hazardous areas to locations of greater safety. The mandate of the City to protect public health, safety and welfare requires the City to ensure that disaster planning within each neighborhood meets both the City's and neighborhood's interpretation of acceptable risk. In issues of overriding safety concerns, the City's mandate requires affirmative action to maximize public safety.

A discussion of emergency response and evacuation must focus on three levels of preparedness: the household, the neighborhood, and the community at large. Specific policy decisions and public actions must be taken at each of these levels to assure an acceptable level of risk for the City's residents.

Household Emergency Planning

Household emergency planning refers to actions which are taken by private citizens to increase their own level of disaster preparedness. Emergency response at this level generally requires the dispatch of specific vehicles to serve specialized functions.

The highest probability of an evacuation occurs from individual households. Isolated occurrences arise due to structural fires or slope failure, as experienced in the February, 1978 storms and again in the Mystic Hills landslides in January, 1993. Evacuation at the household level generally does not require a public agency except to deal with the cause of the evacuation and medical care. Problems associated with response to individual households are generally related to street blockage from insufficient width of paved roadways or grade problems.

Families need to increase their general preparedness for the most likely natural disasters which could occur in their particular location. There are many specific steps which can be taken on the part of a homeowner to gain some autonomy and safety in the case of a natural disaster. Adequate supplies, training and education about the effects of likely disasters and available support systems help in this regard. The City can support these individual household efforts with various services, such as the periodic distribution of emergency planning packets which provide up-to-date emergency planning information and response guidelines.

Neighborhood Emergency Planning

Neighborhood emergency planning requires the neighborhood and community to determine an acceptable level of risk and the resulting public actions to elevate disaster preparedness to that level. Evacuation planning refers to the removal of people from areas of extreme hazards to areas of public safety.

As a result of historic development patterns and constraints imposed by local topography the City is divided into geographic neighborhoods. These neighborhoods are an integral component of emergency response planning. Emergency planning should both incorporate the resources of the individuals within these neighborhoods and recognize the constraints each neighborhood embodies.

A citizen response model could be incorporated into the City's Emergency Services Plan which utilizes a neighborhood coordinate system of planning and response. This Plan could also incorporate a communication component for both information coordination and emergency resources allocation. It might be possible to designate individual neighborhood communication sites and establish emergency local radio broadcasts. Neighborhood Planning could build upon the "neighborhood watch" program. This program has been a victim of funding priorities, but as a response to the requirement of the Emergency Plan to promote neighborhood autonomy, it could be re-invigorated and supported by City staff. For instance, a periodic newsletter could be established to help keep the neighborhoods abreast of the most recent advances in emergency response and coordination.

Community Emergency Planning

Community level emergency planning includes the development of an Emergency Plan to be initiated in the event of a City-wide evacuation. That Plan should include provisions for emergency housing, transportation, clothing, food and medical aid. As neighborhood evacuation planning addresses evacuation routes from various neighborhoods, comprehensive City-wide emergency planning includes the development of a supportive infrastructure responsive to the emergency needs of the community.

As part of a community-wide response to evacuation planning the City's Emergency Plan identifies the roles and relationships of all governmental, quasi-governmental and private service agencies existing within the City and could be updated to inventory facilities within the community available for emergency response needs. This Plan becomes operational in the event of a local emergency and should be periodically updated.

In the event of a community-wide disaster, it is possible that more than one evacuation center would need to be established within the City. The scale of such a disaster would preclude individual evacuation attempts from the community in favor of the efficiency of mass evacuation.

It is doubtful that any roadway could accommodate vehicular evacuation on a community-wide scale.

Citizens relocated to evacuation centers within the community would need to remain in those locations rather than add to the expected confusion on congested roadways. It is not anticipated that any new roadways serving the community would be needed for evacuation needs. In the case of a community-wide disaster, the City would need to have coordinated plans with local military organizations for the airlift of supplies and for evacuation of residents requiring medical care beyond the capability of the community's resources. The City's Emergency Plan could be updated to reflect this needed coordination.

An Emergency Operations Center (EOC) could be established to manage community-wide or neighborhood emergencies. City staff could be utilized for staffing of the EOC and have, at a minimum, annual training events to adequately support its operation. A public information officer could be designated in the Emergency Plan, with procedures for both obtaining and disseminating accurate information.

As with all emergency planning there must be ongoing maintenance and training. This involves the allocation on the part of City government of the necessary funding support for an ongoing emergency management coordinator.

Access Issues

In Laguna Beach there are many isolated neighborhoods which are accessed by only one entry point, which create potentially undesirable, inadequate or hazardous access deficiencies in the event of a disaster. Some of the neighborhoods which have impaired access due to road geometry/configuration problems are: Allview Terrace, Bluebird Canyon, Canyon Acres, Diamond/Crestview, Upper Three Arch Bay and Upper Victoria. (Refer to the Impaired Road Access Map.)

In addition to isolated neighborhoods, many of the City's major roadways are susceptible to circulation restrictions and to geologic or hydrologic hazards which could result in their closure during critical periods. The number of access routes to any neighborhood is less significant than their circulation capacities (parking, travel-way width, etc.) and their susceptibility to closure by hazards.

City of Laguna Beach, California
Department of Community Development
Safety Element of the General Plan

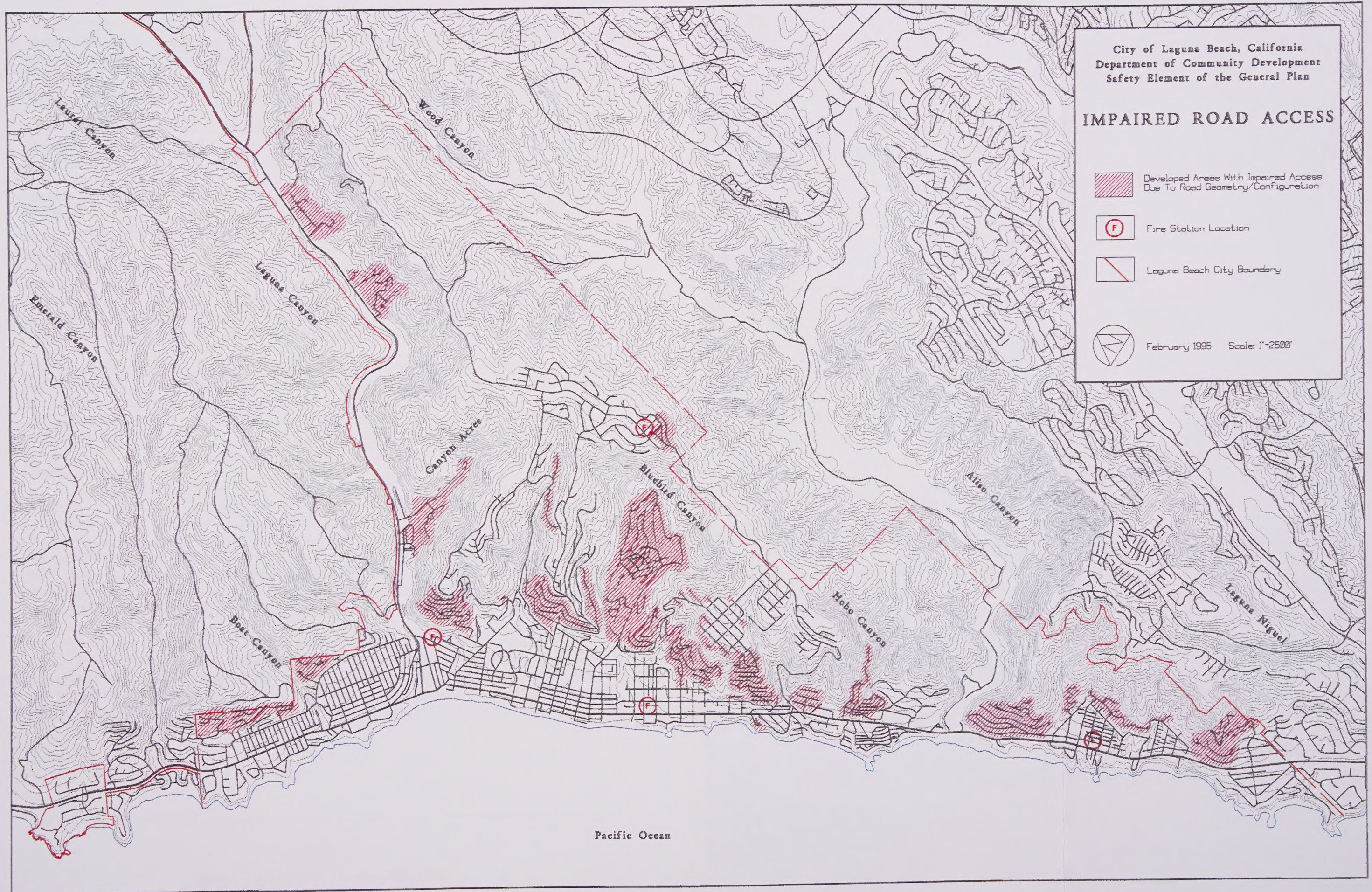
IMPAIRED ROAD ACCESS

 Developed Areas With Impaired Access
Due To Road Geometry/Configuration

 Fire Station Location

 Laguna Beach City Boundary

 February 1995 Scale: 1"=2500'



Some of the neighborhoods, such as Irvine Cove and Upper Victoria, are not subject to major environmental constraints like an identified fault or floodway. These roadways cannot always be expected to remain open, because under even minor adverse conditions, such as a downed tree or electrical line, these areas may become inaccessible.

The City could undertake a comprehensive emergency access evaluation and upgrade program in which each public and private road/trail is evaluated in terms of providing emergency vehicle access and identifying access problems. The goal of this evaluation and upgrade program would be to upgrade the access-deficient areas by retrofitting the substandard roads/routes with non-parking fire lanes (established in conjunction with the affected homeowners), establishing turn-arounds and/or providing secondary access. In addition, an emergency circulation system could be designated for evacuation and response.

The emergency circulation road/route system could be maintained at high priority levels of policy and financial consideration. For instance, the public utility companies could be consulted and encouraged to prioritize the undergrounding of their utility lines along these routes. Tree maintenance could be emphasized on both public right-of-way and private property along these routes. City maintenance of these roads or emergency routes could receive funding priority.

Three of the most severely access-restricted neighborhoods are Bluebird Canyon, Canyon Acres and Diamond/Crestview. These neighborhoods are all single-access neighborhoods and are subject to environmental constraints which could restrict access. All three neighborhoods are particularly susceptible to fire hazards, a situation aggravated by the narrow roadways in each neighborhood.

Bluebird Canyon

Bluebird Canyon is recognized as an area subject to multiple hazards. The major hazards which could minimize access are brush fires and landslides. The neighborhood's isolation, proximity to open space areas, topographic conditions and wind patterns make it susceptible to a wildfire. Similarly, the October, 1978 slide is evidence of the disastrous results of the effects of geologic instability. As a result of these identified hazards, Bluebird Canyon Road could become impassable. In that event, emergency vehicles would be unable to obtain ingress and vehicular egress of the residents would not be possible.

Two separate fire hazards exist in Bluebird Canyon: the threat of wide-front brush fire and the danger of structural fires. The issue of structural fires is most acute in the Dyer-Wyckoff area as a result of small lots, close proximity of structures and narrow roadways. Both types of fires can trigger an evacuation response. Structural fires present less of a need for neighborhood evacuation than do brush fires, unless the fires spread to adjacent structures.

It is imperative to residents' safety that alternative routes of evacuation be established in the Bluebird Canyon area. Any route located too close to the existing roadway could quickly succumb to the same hazard which forced its closure.

The major threat of fire occurrence is east of Bluebird Canyon. The hazards are greatest in this area because of fuel loading conditions and Santa Ana wind patterns. The inclusion of an evacuation route in this direction would have little benefit in leading residents to safety. Similarly, topographic conditions of Rimrock Canyon make the construction of an evacuation route in this area appear to be both aesthetically and economically unsound.

The City needs to continue to investigate and implement an emergency access route that will meet the safety needs of the neighborhood and will be consistent with community economic and environmental goals. An emergency access connection could be established between Flamingo Road and Wykoff Way by obtaining the necessary easements, constructing pavement and installing access-control gates at either end. Secondly, consideration could be given to the construction of a road from Bluebird Canyon to Arch Beach Heights.

Canyon Acres

The Canyon Acres area is exposed to a combination of hazards including: wildfire, geological instability, mudflows and flooding. In the event of a closure on Canyon Acres Drive, the only potential access is a four wheel drive trail connecting with Alta Laguna Boulevard.

Based upon the experience from the October 27, 1993 fire, it is evident that a full-size turnaround is needed at the end of Canyon Acres Drive in order to expedite and facilitate traffic and emergency vehicle access during times of emergency.

For the long term, consideration could be given to installing pavement, fireflow and drainage improvements on the existing graded earth road connecting Canyon Acres Drive with Alta Laguna Boulevard for emergency access/egress. An all-weather surface would minimize annual maintenance, permit fire equipment access and facilitate the maintenance of a fuel modification program to help protect Canyon Acres and Mystic Hills from wildfire potential in the future after regrowth occurs from the 1993 fire storm.

Diamond/Crestview

The Diamond/Crestview area is similar to Bluebird Canyon in that it is adjacent to steep, heavily vegetated hillsides. The Fire Department has expressed concern that a fire started either below or above Crestview Drive could possibly burn everything between Catalina Street and the lower part of Arch Beach Heights. The narrow access aspect of this neighborhood makes it particularly difficult to protect. However, the City is widening the streets and requiring on-street parking as a condition to further development to help alleviate this situation. New houses

and major remodeling projects, as defined in Title 25 of the Municipal Code, constructed in this neighborhood are also required to install residential sprinklers.

Served only by Crestview Drive, the southerly portion of this tract presently has no alternate access. As development occurs, the need for an additional ingress/egress point will increase. A pedestrian walkway between the end of Ruby Place and Crestview Place could be established relatively easily to facilitate evacuations by foot. Vehicular access, however, would involve significant grading and/or retaining-wall construction due to existing terrain conditions. A connection between Inez Street/Fern Street towards Tract 26 (Hermosa Way/Lomita Way) may be available depending upon more detailed site-specific studies for emergency access purposes. However, this option would involve either the placement of fill or the construction of a bridge across a designated natural drainage course.

Undergrounding of Utilities

Overhead utility lines are known hazards which can be mitigated by placing them underground. During the 1993 Laguna Firestorm, downed powerlines in Canyon Acres and other areas restricted and delayed emergency response vehicles and evacuation. Heavy winds cause tree branches to knock down powerlines creating a safety hazard, and power poles and utility boxes are hazards in road rights-of-way.

Policies

- 1A. Periodically review and update the Emergency Services Plan to ensure effective implementation of the Plan during an emergency. Incorporate into the Plan:**
 - (a) a citizen response model using a neighborhood coordinate system, such as a neighborhood watch program;**
 - (b) a comprehensive communications component that maximizes public emergency coordination, response and resource allocation;**
 - (c) a program of coordination with county, regional, state and federal emergency agencies, schools, hospitals and utility companies and their plans; and**
 - (d) a program of coordination with the police.**
- 1B. Amend the Emergency Services Plan to include evacuation plans, and include provisions for emergency shelter, transportation, clothing, food and medical aid, identifying the facilities and persons within the community that may be utilized in an emergency and communicating this information to neighborhood associations and the American Red Cross.**
- 1C. Establish an Emergency Operations Center (EOC) and provide for its adequate support and staffing, including the acquisition and maintenance of a mobile Incident Command Support vehicle for emergency response.**
- 1D. Establish, appoint and maintain the position of a full-time emergency management coordinator whose duties shall include, but not be limited to, ongoing training for and operation of the Emergency Operation Center, neighborhood emergency planning and support, ongoing maintenance of the Emergency Services Plan, general public training and education, and the implementation of the City's emergency planning and coordination.**
- 1E. Ensure the periodic participation of appropriate City staff members in exercises designed to familiarize them with disaster response procedures and operational support for the Emergency Operations Center.**
- 1F. Promote public awareness in emergency response preparedness by any effective informational media, such as an Emergency Preparedness Newsletter, neighborhood posters and regular presentations at neighborhood association meetings.**

- 1G. Ensure that disaster preparedness exercises by involved agencies are frequent enough in order to help improve the efficiency of participating mutual aid agencies.**
- 1H. Ensure that any new street which serves as access to residential development of five or more dwelling units has a minimum of two contiguous 10-foot-wide paved travel lanes that will remain unobstructed at all times.**
- 1I. Undertake a comprehensive emergency access evaluation and upgrade program that:**
 - (a) evaluates each public and private road and neighborhood in terms of providing emergency vehicle access and evacuation routes, including pedestrian accessways or trails;**
 - (b) upgrades access-deficient roads by retrofitting them with no-parking fire lanes (established in conjunction with the affected homeowners), turn-arounds, and/or secondary access; and**
 - (c) develops a primary and secondary emergency circulation plan for evacuation and emergency response.**
- 1J. Encourage emergency vehicular access that is of a sufficient width to allow people and emergency equipment into the hazard area and still allow for evacuation, if needed.**
- 1K. Establish and maintain no parking/tow away zones in all critical areas where feasible to keep travel lanes and street turnaround areas unobstructed at all times.**

- 1L.** Limit residential development to 24 building sites when a single means of ingress and egress or a cul-de-sac is proposed and require two means of ingress/egress where emergency equipment deployment and evacuation traffic are in excess of the design capacity of a single ingress/egress route. Any existing parcel which is considered to be a legal building site shall be exempt from this policy standard for the purposes of development on the parcel as one building site, but the policy shall be observed for the creation of new building sites. The secondary emergency access route may be a public access easement on private property, but must be paved, may be restricted to emergency access uses only and must be certified as functional by the Fire Department during an emergency. The City shall not approve a variance from this standard unless findings are made that: 1) the Fire Department has reviewed the variance application and certified that long-term public health and safety has been established for emergency access through the provision of additional safeguards, including but not limited to, adequate fire flow and hydrants, requiring sprinklers, additional street width, additional turn-arounds and maintained fuel modification zones; and 2) the road leading up to any road or driveway extension complies with City access standards regarding width and grade.
- 1M.** Limit a single means of ingress and egress or cul-de-sac to a maximum length of 750 feet. Private driveways shall not exceed 150 feet in length without providing a turnaround, loop circulation or secondary emergency access. Any existing parcel which is considered to be a legal building site shall be exempt from this policy standard for the purposes of development on the parcel as one building site, but the policy shall be observed for the creation of new building sites. The City shall not approve a variance from this standard unless findings are made that: 1) the Fire Department has reviewed the variance application and certified that long-term public health and safety has been established for emergency access through the provision of additional safeguards, including but not limited to, adequate fire flow and hydrants, requiring sprinklers, additional street width, additional turn-arounds and maintained fuel modification zones; and 2) the road leading up to any road or driveway extension complies with City access standards regarding width and grade.
- 1N.** Evaluate the location of all public facilities necessary for emergency response in relation to the current City's Hazard Maps and the level of risk associated with their locations and move facilities located in high or extreme hazard areas to areas less subject to hazards, if feasible.

- 1O. Ensure that any new public facilities are designed and located in such a manner as to eliminate potential hazard impacts that may reduce the utility of the facility following a disaster.**
- 1P. Inform utility companies of potential conflicts between the location of their facilities and the currently identified high or extreme hazard areas and encourage them to program for relocation or undergrounding of potentially impacted facilities, especially along designated primary emergency routes.**
- 1Q. Evaluate the City's ability to relocate service equipment, facilities and the seat of government on an emergency basis in the event of the occurrence of a hazard that might impact existing service locations.**
- 1R. Initiate discussion with utility companies to identify, establish and maintain local emergency service facilities.**
- 1S. Continue to encourage the undergrounding of utilities in existing developed areas of the City and require any new development to underground utilities.**

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TOPIC 2: HAZARDOUS MATERIALS

There are many definitions and descriptive names being used for the term *hazardous materials*, each of which depends on the nature of the material. For the purposes of this topic, the definition in § 25501(k) of the Health and Safety Code will be utilized:

"any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the work place or the environment. Hazardous materials include, but are not limited to hazardous substances, hazardous waste, and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the work place or the environment."

Hazardous materials are manufactured, transported, stored, used and disposed of on a regular basis. Although hazardous materials incidents can happen almost anywhere, certain areas are at higher risk. Areas near roadways, railways, pipelines, airways and waterways that are frequently used for transporting hazardous materials and areas near industrial facilities that use, store, or dispose of such materials have an increased risk. The primary transportation routes of hazardous materials in Orange County, near the City of Laguna Beach, are the I-5 and I-405 freeways. Some transportation of hazardous materials occurs on Coast Highway and Laguna Canyon Road within the City. Within the County, the Santa Fe and Southern Pacific Railroads operate 155 miles of railroad lines which transport large quantities of hazardous materials. The City does not have direct authority to regulate the transport of hazardous materials on State Highways or rail lines. United States Department of Transportation regulations establish criteria for safe handling and transportation of hazardous materials.

Numerous petroleum product producers with large storage facilities maintain hundreds of miles of pipelines throughout the county. However, none of the major pipelines pass through the City of Laguna Beach. The airspace around the City of Laguna Beach is among the busiest in the nation. Hazardous materials may be transported by air over Laguna Beach or to destinations at John Wayne Airport or El Toro and Marine Corps Helicopter Station, Tustin. Finally, because Laguna Beach is a coastal city, it is exposed to oil tanker traffic as well as other ships carrying hazardous materials.

Because of the distance of the major hazardous materials transportation routes from the City of Laguna Beach, the threat of a significant hazardous materials emergency is minimal. The potential magnitude of hazardous materials incidents will be largely affected by prevailing weather conditions and topography at the incident scene. Wind direction and velocity, ambient air and ground temperature and precipitation and humidity will affect the spread of gases,

vapors, mists, and the dusts of hazardous materials. Topography can greatly affect the behavior of gases and liquids.

The most likely hazardous materials exposure is use of hazardous materials within the City limits. Household cleaning products, pool chlorine, dry cleaning chemicals, film processing, jewelry making, hospitals and automobile servicing involve hazardous materials and wastes. The Laguna Beach Fire Department needs to continue to identify and monitor commercial and industrial users of hazardous materials. It is not reasonable to closely monitor the use of household hazardous materials, but the City has committed, through its state-mandated Household Hazardous Waste Plan, to several actions, including educational campaigns regarding reduced usage and proper disposal; promoting the County's Household Hazardous Waste Collection Centers (the nearest are located in Irvine and San Juan Capistrano); and negotiating for annual County-sponsored collection events in Laguna Beach. (Each of these collection events costs between thirty and fifty thousand dollars, for an estimated 300 to 400 users or participants.)

In March, 1994, the City Council adopted the County of Orange Hazardous Materials Area Plan. This is a state-mandated plan with established criteria. The primary goal of this plan is to achieve the preservation of life, property and environment with the most effective and economical allocation of resources in time of a hazardous materials emergency. The City of Laguna Beach is also a participant in the Orange County Hazardous Waste Management Plan which provides options for siting of hazardous waste collection, treatment, recycling and disposal facilities throughout the County. Together, these Plans establish the City's responsibilities and goals and policies in dealing with a hazardous materials incident and with the identification, storage and disposal of hazardous materials and wastes.

The City presently requires the participation of businesses in the Hazardous Materials Disclosure Program. This involves the disclosure, at the time of obtaining a City business license, of whether the business will generate or use any of the hazardous materials contained on the list of such materials, as well as their quantities. This information is forwarded to the Orange County Fire Department, Hazardous Materials Program Office, which forwards a schedule of onsite inspections to the City Fire Department. These inspections currently occur at one- to two-year intervals. During the inspections, there is a review of the businesses' hazardous material safe-handling, storage, dispensing and disposal criteria. Any noted disposal violations are reported to the County for appropriate follow-up.

The City presently operates a Small Hazardous Material Spills response vehicle that is primarily used in cleaning up spills associated with vehicular accidents. Large spills of hazardous materials would involve a response from the Orange County Fire Department, which has four Level A Hazardous Materials Mobile Units. The City has a joint powers agreement with the County for mutual aid and joint cost support of these units. In very large spills of hazardous materials, a responsible party is identified and private firms are contracted with for an appropriate safe clean-up of the site at the responsible party's expense.

Gasoline in underground storage tanks in service stations is considered to be a hazardous material. State, County and City Health and Fire Codes require special tanks for underground storage. Laguna Beach has completed the program of removing the known non-complying tanks. Monitoring of some sites is still taking place to identify any contaminants requiring clean-up.

Marine oil spills are considered to be a hazardous material emergency and are typically multi-jurisdictional events. The City of Laguna Beach is a participant in the Orange County Operational Area Marine Oil Spill Contingency Plan (OSCP). The OSCP is a component of the Orange County Hazardous Materials Area Plan. The Office of Oil Spill Prevention and Response (OSPR) and the U.S. Coast Guard have primary responsibilities for the cleanup and response effort in coordination with the responsible party. The shoreline is a very significant environmental and recreational resource to the City that could be adversely affected in the event of an oil spill. The City of Laguna Beach will continue to oppose offshore oil drilling when environmental, aesthetic and economic resources are threatened and will continue to monitor the federal government's offshore leasing program to ensure that the impacts of the program on the coastal environment are known and considered.

Another possible source of a hazardous material is a sewage spill or a mixing of sewage, industrial waste or pollutant discharges with storm drainage waters. This is naturally not acceptable, but operational maintenance and system capacities must support the strict performance standard of proper separation and treatment.

Aliso Creek and Laguna Canyon Stream are two areas that have been particularly problematic in regards to water quality. The State Water Quality Control Board is charged with the responsibility for improving water quality in creeks and the ocean. The San Diego Regional Water Quality Control Board has jurisdiction over Aliso Creek. Six agencies which form the Aliso Water Management Agency (AWMA) have pipes that crisscross and parallel Aliso Creek. Iron pipes run beneath the banks of the creek, some transporting sewage, others moving thick sludge between the four treatment plants that receive the sewage. There have been numerous sewage spills that travel downstream to the ocean which have caused Orange County health officials to close Aliso Beach more than any other beach in the County. Spills can have serious health consequences for swimmers. Human wastes carry bacteria and viruses that can cause hepatitis and typhoid fever, although the most common ailment is diarrhea according to Orange County health officials. The Laguna Beach City Council has petitioned the Regional Water Quality Control Board and all of the agencies providing sewer collection and treatment in the Aliso Creek Basin to solve the sewage spill problems.

Policies

- 2A. Coordinate with Federal, State and County hazardous waste management plans to protect the health and welfare of the public, the environment and the economy of the City of Laguna Beach through comprehensive programs that ensure safe and responsible management of hazardous waste and materials.**
- 2B. Implement the measures outlined in the City's Household Hazardous Waste Plan, Orange County's Hazardous Waste Management Plan and Hazardous Materials Area Plan, and the County's Operational Area Marine Oil Spill Contingency Plan to ensure the effective management, transportation and disposal of hazardous waste on a City-wide level.**
- 2C. Support enforcement of State "right to know" laws, which outline the public's right to information about local toxic producers.**
- 2D. Encourage and support the use of alternatives to toxic materials in the home and yard.**
- 2E. Encourage and support the use of central drop-off centers and/or mobile collection vehicles for proper disposal of hazardous materials. Investigate the establishment of drop-off centers and/or mobile collection vehicles within the City and the establishment of a user fee to pay for such services.**
- 2F. Facilitate coordinated, effective response to hazardous materials emergencies in the City to minimize health and environmental risks.**
- 2G. Promote public awareness in hazardous materials emergency response preparedness by any effective informational media, such as an Emergency Preparedness Newsletter, neighborhood posters, and at least annual presentations at neighborhood association meetings.**
- 2H. Continue the Laguna Beach Fire Department's hazardous materials disclosure program. Make annual inspections of businesses which generate or use hazardous materials, and identify and monitor any historical hazardous materials sites within the City for public health and safety issues.**
- 2I. Promote public participation and education in the implementation of the programs identified in the County's Hazardous Materials Management Program.**
- 2J. Encourage the Fire Department to monitor the flow of hazardous materials through the City to ensure public safety. (10D of Circulation Element)**

- 2K. Encourage coordination between the City Fire and Police Departments with the County Fire and Sheriffs Departments in the designation of routes and enforcement of hazardous materials, routing ordinances and laws, with Pacific Coast Highway as the primary designated route. (10E of Circulation Element)**
- 2L. Oppose offshore oil leasing because potential offshore oil spills are a hazard to people and marine resources.**
- 2M. Monitor the federal government's offshore oil leasing program to ensure that the impacts of the program on the coastal environment are known and considered. (4-B of Land Use Element)**
- 2N. Facilitate the proper separation of sewer and storm drain systems through construction upgrades and operation and maintenance of sewer and storm drain infrastructure to eliminate the flow of sewage into the City storm drains.**
- 2O. Facilitate coordination and participation by all of the jurisdictions that make up the Aliso Water Management Agencies to improve water quality. Eliminate sewer discharges and non-point source pollution into Aliso and Laguna Canyon Creeks.**
- 2P. Maintain an understanding of the potential risks to the City in the event of a threatened radioactive contamination episode from the San Onofre Nuclear Generating Station and implement appropriate emergency warning systems and evacuation procedures.**
- 2Q. Monitor the conversion of El Toro Marine Corp Air Station and attempt to minimize the impacts of potential future uses, such as a commercial airport, on the City of Laguna Beach and its ambient noise condition and air quality.**
- 2R. Minimize the presence of animal fecal waste which jeopardizes the public health.**

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TOPIC 3: GEOLOGIC HAZARDS

Local Conditions

In December of 1969, the City commissioned an analysis of the geology of Laguna Beach on a city-wide basis by Leighton and Associates. The prologue states that geologic information will not go out of date because the geology of the area originated through geologic ages and will change little in man's lifetime. The geologic history of Laguna Beach, as described in the Leighton and Associates 1969 study, is paraphrased as follows:

The geologic record of Laguna Beach extends back approximately 30 million years through the analysis of earth materials, the structure of these materials, landscape features and fossils. This record begins with old beach sands that have transformed into the Topanga sandstone of Miocene age. Sedimentary layers were formed through marine deposits in Miocene seas which were gradually compacted and cemented. The layers were uplifted from a near horizontal position into broad arch-like folds called anticlines. The most recent uplift occurred during the last 250,000 years. On the basis of radioactive dating beach deposits of approximately 130,000 years ago are found at the lower terrace of the downtown area of the City and over 250,000 years at the highest points of Temple Hills and Top of the World.

Earth materials can be divided into surficial sediment and bedrock. Surficial sediment is of more recent geologic origin and consists of alluvium (stream deposits), colluvium (thick soil and slope wash), beach deposits, terrace deposits of marine origin and of non-marine origin. Bedrock is older and consists of Topanga Sandstone, Topanga Siltstone, San Onofre Breccia and intrusive igneous bodies.

The City of Laguna Beach can be divided into four areas with unique topographic and geologic characteristics called **geomorphic subareas**. Each of these involve separate constraints in terms of geology and requires different types of engineering when development occurs. These subareas of the City are important in order to understand their different stability qualities.

The first subarea is the **Major Canyons**, including the side slopes of Laguna Canyon, Hidden Valley Canyon, Rimrock Canyon, Bluebird Canyon and Aliso Canyon. Steep slopes are common because of the resistant exposed rocks and the large amount of uplift and erosion in a relatively short geologic time frame. The slopes descending from bluffs and ridges differ greatly in stability and cohesiveness.

The **Canyon bottomlands** subarea is not widespread and is mainly limited to the floor of Laguna Canyon and its tributaries. The downtown basin is located at the mouth of this system and exemplifies the characteristic construction hazards. Poorly consolidated, fine-grained and water-

soaked soil materials of considerable depth have required careful foundation design and construction, usually with pilings driven deep to support large structures. Further up the watershed, conditions are different. Soil materials are usually more sandy and the water table deeper, usually more stable. Even here, differential settlement can crack poorly constructed foundations, especially where improper drainage of rainwater (due to the lack of rain gutters, for example) is a contributing cause. Sedimentation in lowland areas can slowly raise the land level around a structure. The rate of this normal increase is slow enough that there is generally little awareness of this phenomenon.

The next subarea is the **High Terrace**, the flat-lying summit platforms of Temple Hills and Top of the World, Arch Beach Heights and the interconnecting ridge, which are mostly the remnants of elevated marine terraces. The highland areas of Laguna Beach began their formation as a series of layered sediments, most deposited beneath the sea. Volcanic activity injected a hard rock into several fissures. While these processes were occurring, seismic forces folded, faulted, and lifted the mass above sea level, allowing erosion to attack the layers of rock creating sandstone cliffs with cavernous weathering. Erosion and landsliding can affect these areas, but problems associated with groundwater seepage are less likely.

The final subarea is the **Coastal Fringe**, which includes the broad coastal shelf traversed by Pacific Coast Highway. Included within this area are the headlands, cliffs and associated sea arches, caves and blow-holes, the beaches and the offshore islands and rock prominences. The coastal shelf is generally smooth and its broad, nearly level expanses invited early development. The shelf is composed of young and sometimes poorly consolidated sands and clays, which can pose construction problems due to lack of stable support. This condition is found most often at the edges of the bluffs where the emergence of springs can aggravate the problems. The central areas of the bluffs are mostly free from this condition. The bedrock formations in the northern portion of the City are primarily Topanga sandstones and siltstones, and are primarily San Onofre Breccia in the southern portion of the City. The Coastal Fringe terminates abruptly at the sea cliff, which are steep and sometimes nearly vertical. Some of the problems associated with this terrain are as follows: terrace materials subject to soil engineering problems; erosion materials from concentrated runoff descending over the cliff face; ground water seeps; rock falls; potential slide blocks; sea cliff erosion from wave impact; and collapse of sea caves and sea arches.

The local landforms were primarily caused by normal erosion and wave action working on the layers of rock which have been altered from their original position. The harder and more resistant layers tended to remain as outcroppings, sometimes forming steep cliffs; the softer rock was more readily removed, allowing stream action to form canyons and other relatively depressed areas. Within the last 10,000 years or so, thick deposits of talus have accumulated at the base of some slopes. Analysis of aerial photography has shown regions where landsliding has occurred, thereby suggesting a degree of innate instability for some types of rock.

Landslides

The Federal Emergency Management Agency (FEMA) defines a *landslide* as:

"Downward and outward movement of slope-forming materials composed of natural rock, soils, artificial fills, or combinations of these materials. The moving mass may be proceeded by any of three principal types of movement: falling, sliding, or flowing or by their combinations."

Although the term *landslide* is generally assumed to mean any slide of rock or soil down a hill, the term actually encompasses a number of different types of earth movements. Lateral shifts of level ground or rotational movement of land triggered by heavy saturation, liquefaction or earthquakes are also classified as landslides. An ancient landslide can lie dormant for years with imperceptible creep and gradual consolidation and settlement. Gradually the shear strength of the old slide mass is overcome and reactivation occurs as a slow or rapid movement.

The occurrence of landslides is a part of the continuous, natural process of the downhill movement of soil, rock, and rock debris. The speed at which this earth material moves downslope can range from imperceptible creep of soil to sudden mass movements of an entire hillside. The size of a landslide can range from several square feet in area to several square miles. Slide thickness may range from less than a foot to several hundred feet. It is important to remember that the complex arrangement of earth and rock units sometimes results in one piece of land having a sound and stable geological foundation while another piece immediately adjacent, perhaps on the same lot, may be entirely different and potentially unstable. It is therefore necessary to study each development proposal individually.

Landslides can cause substantial damage and disruption in the City of Laguna Beach. Landslides can cause death, destroy entire neighborhoods, cause substantial damage to and loss of public improvements, block drainage channels, and disrupt utilities and pipelines.

Many known bedrock and surficial landslides exist in the hilly portions of Laguna Beach. Many of these slides are ancient bedrock slides which are at present stabilized or in equilibrium. In most cases in which an ancient landslide begins to slip, water-saturated hillsides are the cause. Where bedding and jointing of rock materials and hill slope directions tend to be the same, slide possibilities are greatly increased. Although these areas may remain stable for hundreds of years, triggering forces may cause failure at any time.

In addition to the known landslide areas, there are several areas subject to potential slope instability due to slide-prone formations occurring in the bedrock. The massive slide in the Meadowlark Drive area of Bluebird Canyon occurred within the area of an ancient landslide. The relationship of rock type (clayey siltstone) and geologic structure (dip-slope) to the slope height and slope angle provided the fundamental geological and geometrical basis for failure.

However, this landslide was triggered by a combination of the heavy infiltrating rains of 1978 and the removal of earth material at the toe of the landslide by erosion and sloughing.

A secondary impact associated with landslides is the creation of a temporary dam when a slide blocks a major drainage course. This situation was also experienced in the Bluebird Canyon slide. Without adequate drainage, these dams may impound runoff water from the upstream watershed. These dams are certain to fail within a relatively short time, presenting an inundation hazard to developed areas below.

Landslide Hazard Reduction

Damage due to landslides can be reduced through avoidance, removal or permanent stabilization. The first step is to recognize the existence of an ancient landslide or the probability of a future landslide. This is accomplished through detailed geologic mapping, trenching, drilling and photo interpretation of surface geologic conditions. Ancient landslides located in undisturbed and undeveloped areas are the easiest to detect through the use of photo interpretation. Detection in developed areas may be much more difficult because the characteristic features of landslides' lobe-like forms and track-like hollows are often obscured. Probable future slides can often be anticipated in areas where other landsliding has already taken place. Hillsides covered with deep soils or that are heavily saturated with groundwater may be potential landslide areas. Additionally, landslide possibilities are greatly increased where the bedrock and hill slope directions tend to be the same.

In order to determine the precise origin of the topographic form, it is necessary to conduct supplementary subsurface explorations. Once the configuration of a potentially active landslide is known by subsurface investigation, the threshold values of failure can be calculated. A value of 1.0 represents equilibrium, where the forces resisting failure or movement equal those forces which cause failure. A value below 1.0 would indicate where a geological failure (i.e., landslide) is expected to occur. The present minimum accepted level of safety value is 1.5, which means that the geological feature is 50% stronger than equilibrium or the forces promoting failure.

When an area is recognized as a potentially hazardous landslide area, future development can be designed to take this into consideration and existing development can take mitigating actions to reduce potential hazards to an acceptable level. Several methods of minimizing landslide risks include:

- 1) Leaving hazardous areas undeveloped.
- 2) Removing unstable slope material.
- 3) Engineering grading prior to construction.

- 4) Providing for roof, surface and subsurface drainage.
- 5) Constructing retaining walls or other barriers to buttress ancient slides.
- 6) Reducing the driving forces acting on the slope by reducing the slope angle or the weight of objects placed on the slope.
- 7) Planting drought-resistant vegetation with deep, strong root systems.

Although these techniques represent effective mitigation to protect development from geologic instability, they cannot ultimately guarantee control over the forces of nature. Diligent investigation, analysis and reporting is essential in making informed land use decisions, but should not be viewed as being absolutely definitive because extreme events, such as unusually heavy precipitation or severe seismic events, are not predictable.

Seismicity & Liquefaction

Faults, which represent fractures in the earth's crust, are not always easy to identify, especially in areas that are obscured by development. Through analysis of existing land formations and subsurface investigation, geologists can identify the location of many faults. A fault may be a single continuous line, but more likely may be a system of splinter faults and breaks, which together constitute a fault zone.

There are three types of fault classifications:

- 1) **Active** faults have experienced movement within the last 11,000 years (Holocene time) and may move again in the relatively near future.
- 2) **Potentially active** faults have moved in the last two million years (Quaternary Period) but show no direct evidence of movement within the last 11,000 years.
- 3) **Inactive** faults show no evidence of movement since Pleistocene times and present no evidence of potential to move in the near future.

It should be noted that the words "inactive" and "potentially active" are used by seismologist as concise technical terms, to describe the past activity of any fault. Analysis shows that an "inactive" fault is least likely to generate an earthquake, but its continued inactivity is not assured since attempting to predict the future on the basis of historic trends is always speculative.

Seismic Measurement

Earthquakes are measured two different ways - the Richter scale (magnitude of energy released) and the Modified Mercalli scale (intensity of movement or affects of shaking).

The Richter scale is a well known, but often misunderstood, system used primarily by seismologists to evaluate and compare the energy of individual quakes according to an absolute and objective scale. The magnitude of energy released is calculated from the instrumental record made by the event on a calibrated *seismograph*. Seismographs record a zigzag trace that shows the varying amplitude of ground oscillations beneath the instrument. Magnitude is expressed in whole numbers and decimal fractions. Because of the logarithmic basis of the scale, each whole number increase in magnitude corresponds to the release of about 30 times more energy than the amount associated with the preceding whole number value. The 1906 San Francisco earthquake with a magnitude 8.3 generated 1,000,000 times as much energy as the 4.3 magnitude earthquake that occurred in Laguna Beach in 1969. Furthermore, the Richter magnitude does not give any indication of the actual damage caused by the quake. Other factors must be considered: distance to the epicenter, and its focal depth as well as geological conditions at the location of damage. Even with these data the Richter magnitude is more meaningful and useful to the scientist than the layman.

The Modified Mercalli scale is subjective and related not to the energy released, but to people's perception of the quake and the damage done, as determined by field surveys. This scale is much more significant to the public since its steps are delineated by cracked plaster, fallen buildings, ground failure, and citizens' panic, rather than energy relationships measured by instruments. The Modified Mercalli Scale as shown on Table I provides a description of the effect of the different levels of earthquake intensity with the corresponding Richter Scale.

Regional Seismic Conditions

Southern California is located in a seismically active area. (Refer to the Regional Seismic and Geologic Hazard Maps.) There have been many earthquakes throughout recorded history; some have been large. The 1933 Long Beach quake was the most powerful and closest shock to hit Laguna Beach in living memory, and the 1994 Northridge quake was the most recent powerful shock. Both of these were felt widely across the Los Angeles basin and caused considerable damage. In October, 1969, a quake occurred which was felt predominantly in Laguna Beach and South Laguna. By way of comparison, the three quakes listed above had the following Richter magnitudes: 1933 Long Beach, 6.3; 1994 Northridge, 6.8; 1969 Laguna Beach, 4.3. The respective Mercalli magnitudes as perceived in Laguna Beach were VI, V and V.

Table I - Modified Mercalli Intensity Scale

The first scale to reflect earthquake intensities was developed by de Rossi of Italy, and Forel of Switzerland, in the 1880's. This scale, with values from I to X, was used for about two decades. A need for a more refined scale increased with the advancement of the science of seismology, and in 1902 the Italian seismologist, Mercalli, devised a new scale of a I to XII range. The Mercalli Scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neuman to take into account modern structural features:

I	(2)	Not felt except by a very few under especially favorable circumstances.
II	(2)	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	(3)	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Vibration like passing truck. Duration estimated.
IV	(4)	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	(4)	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken. a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	(5)	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	(5-6)	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly-built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
VIII	(6)	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly-built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	(7)	Damage considerable in specially designed structures; well designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	(7-8+)	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundation; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	(8+)	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	(8+)	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seem on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.

Note: Numbers in parenthesis denote Richter Magnitude.

Source: "California Geology", September 1984.

The active faults of Southern California will continue to be subjected to stresses which produce movements that in turn cause earthquakes of varying magnitude and intensity. Earthquakes along active faults will, more than likely, be of the same magnitude as those experienced in the past, and large earthquakes will most likely occur where they have previously occurred.

Local Seismic Conditions

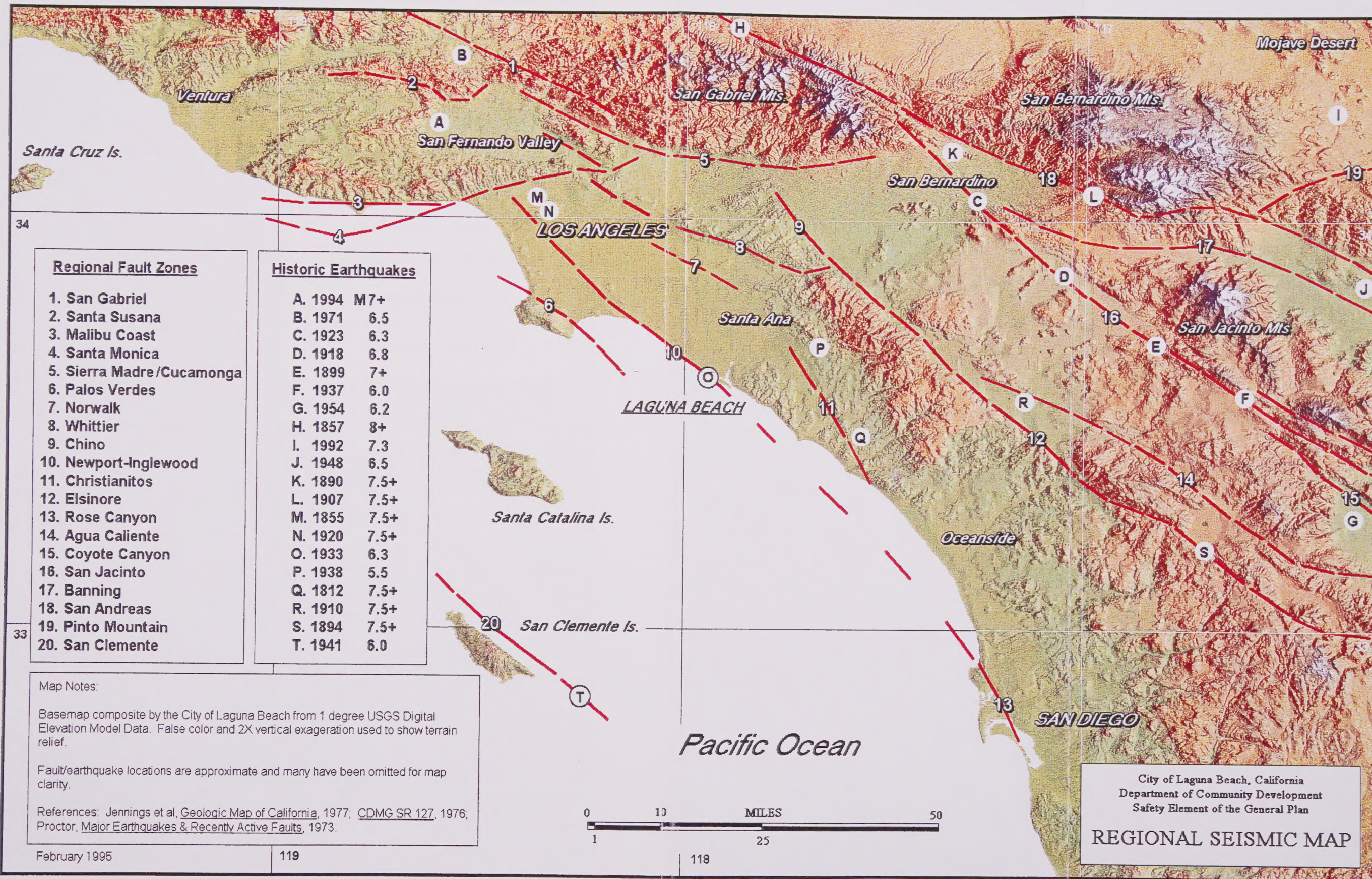
The City of Laguna Beach lies on the western flank of the San Joaquin Hills. The three dominant active fault systems of this geomorphic area in which these hills occur are the Newport-Inglewood (3 miles west), Whittier-Elsinore (20.5 miles northeast), and the San Jacinto (42.5 miles northeast). These faults all trend in a northwesterly direction and divide the province into subparallel blocks each of which contains a complex system of older faults. There are also distant faults that could affect Laguna Beach by generating a powerful shock, such as the San Andreas and the San Jacinto, two great faults which have shown activity in historic times. The most destructive earthquake experienced in the Laguna Beach area occurred in 1812 and was probably centered near San Juan Capistrano or on an undetermined offshore fault, perhaps on or related to the Newport-Inglewood Fault Zone. The activity of the Christianitos fault, which passes roughly from San Onofre to El Toro, is a matter of question among the experts.

Although there are no active or potentially active faults in Laguna Beach, the City is traversed by two major inactive fault systems, the Laguna Canyon Fault and the Temple Hills Fault. It is unlikely that these faults will experience activity in the near-future since there is no record of faulting in historical times or in the geologic record of the last 11,000 years. The Laguna Canyon fault zone consists of two parallel northwest-trending faults across Laguna Canyon; north of this canyon, the zone forms a single fault. The Laguna Canyon fault system is best revealed by the eroded saddles on ridges and a steep scarp at the head of Bluebird and Rimrock Canyons. This fault can be followed from Thousand-Steps Beach in South Laguna to the vicinity of the University of California, Irvine.

The Temple Hills fault trends in an easterly direction. The Temple Hills fault is not as visibly apparent, and also trends in an east-west direction subparallel to the Laguna Canyon fault. Its trace runs from one mile east of Aliso Canyon to the downtown basin.

Many other smaller faults have been discovered by geological surveys, which are roughly parallel to one or the other of these two major systems. Most of these faults have been determined to be technically inactive.

Because no active faults cross the City, the overall constraint or hazard from fault rupture is considered low. However, it is not advisable to build a structure across a major inactive fault such as the Temple Hills fault and Laguna Canyon fault.



City of Laguna Beach, California
Department of Community Development
Safety Element of the General Plan

GEOLOGIC HAZARD MAP

-  Landslide / Earthflow
-  Fault Lines (Inactive)
-  Areas of Potential Slope Instability
(Study Area Limited to Central Laguna)
-  Surface Creep / Mudflow
-  Feature Inferred / Uncertain
-  Laguna Beach City Boundary
-  February 1995 Scale: 1"=2500'



This map shows generalized information from different sources.
Suitability of specific sites for specific uses must be confirmed.

Ground Rupture and Shaking

The most significant hazard from an earthquake is ground-shaking. Far more damage is caused by shaking than by actual surface rupture. The factors determining the degree of ground shaking at a given location are:

1. Distance from the earthquake epicenter (and focal depth).
2. Size (force) of magnitude.
3. Local soil, geologic and groundwater conditions.

An earthquake generated nearby can be felt as a single, severe jolt, such as the 1969 Laguna Beach quake. Coming from a slightly greater distance, a double shock with lesser acceleration but a longer period of shaking is experienced. The 1933 Long Beach earthquake was felt in Laguna Beach in this manner. The Northridge earthquake caused prolonged shaking due to long frequency waves.

The greatest hazard from ground-shaking is the effect on the structures and the occupants of the structures. The manner in which structures respond to earth movements is dependent upon the type of construction, the underlying geology and the magnitude and distance of the earthquake.

Statewide seismic design standards for new construction were not included in building codes until 1933, after the Long Beach earthquake. Although seismic design standards have improved over the years, they are minimum standards and will not make buildings completely resistant to damage from earthquakes. Seismic design standards are only meant to increase structural stability, reduce damage and minimize loss of life.

Generally, certain types of construction withstand ground movement better than others. Wood-frame, single-story residential structures are the most stable during an earthquake. Structures with unreinforced masonry walls are the structures most susceptible to damage. Unreinforced masonry construction was prevalent during the late 1800's to early 1900's for commercial structures. Approximately 30 such structures exist today in Laguna Beach. However, Senate Bill 547 required inventories and mitigation plans to be submitted to the State by January 1, 1990 to correct these structural hazards. Two-thirds of these commercial unreinforced masonry structures in Laguna Beach have completed the retrofitting process. The remainder must be completed by 1997.

The local geology affects the intensity of earthquake shockwaves as they pass through the area. A large portion of Laguna Beach is located on highland areas underlain by bedrock and the cementation and elasticity of this natural foundation allow the groundwaves to travel faster than

they would through areas of thick alluvial sediments. Severe damage to structures results where tall structures are built over thick, soft, water-saturated soils. The area which can expect the most damage to structures is the lowland alluvial regions of Laguna Canyon, its tributaries and the downtown basin. Here the sediments lack the density and cementation of upland regions and the shaking is likely to be more intense. The presence of a high water table can make damage worse. Areas of thick surficial soils on hillsides may also be susceptible to increased shaking. Geologic conditions vary so markedly that one of two adjoining lots may be on sound bedrock and the other on less stable soils. For this reason, each individual site must be evaluated to determine the seismic standards necessary for construction.

Some facilities warrant special seismic standards because of their occupancy and/or their function. Schools, hospitals and facilities necessary for emergency operations fall into this category. Other facilities, such as utility lines, warrant special attention to siting and seismic design standards. The Uniform Building Code addresses these facilities under the classification of "essential facilities." Public schools in California fall under the approval authority of the State Architect, which enforces the high standards of earthquake bracing for all new schools. Hospitals, clinics and nursing homes fall under the jurisdiction of the Office of Statewide Health Planning and Development. Seismic standards are enforced on all other structures by the City.

A major earthquake of magnitude 7 or greater (Richter) on the Newport-Inglewood fault could have serious effects on the lifelines (facilities such as highways, bridges, electrical power lines, gas lines, water and sewage lines and communication lines) in Laguna Beach according to Special Report 99, prepared by the Division of Mines and Geology and the Department of Conservation. The quake would cause Pacific Coast Highway to be blocked by severe pavement breakage and liquefaction failures. The bridge at Aliso Creek could suffer extensive damage. Intense shaking and ground failures would damage electrical power transmission towers and lines and would result in power outages. Underground waste water pipelines could be expected to perform reasonably well except in liquefaction areas, where significant damage should be anticipated. Potential failure locations are at connections between service lines and transmission lines. In addition to loss of sanitary sewer service to thousands of people, the most serious impact of the projected damage to the waste water system would be the contamination problems of the discharge of untreated sewage into the ground, streets and ocean. The primary impact on natural gas facilities would be fires, which could be expected due to broken gas mains and service connections in the areas of high liquefaction potential. Fires can be very difficult to deal with when there are damaged roadways and broken water lines, combined with disrupted communication lines. Preparedness for seismic disturbance is of very great importance relative to gas service.

Liquefaction

Liquefaction refers to a phenomenon in which water-saturated granular soils behave like a liquid when intergranular water pressure moves the grains apart. To have potential for liquefaction, three simultaneous conditions are necessary: cohesion-less soils, high groundwater, and degree of ground-shaking. Sediments of the Holocene age (less than 11,000 years) are more susceptible to liquefaction than older sediments. Stream and estuarine deposits in which the water table is high generally have a high potential for liquefaction.

Buildings, utilities, transportation facilities and reservoirs in these areas are subject to damage because the soils lose their ability to support structures. Liquefaction potential in Laguna Beach is based primarily upon the association of alluvial areas with shallow or potentially shallow groundwater depths (less than 20+ feet). A liquefaction evaluation of specific sites is necessary to mitigate potential hazards for new construction.

Seismically Induced Settlement and Slope Failure

In the absence of a shallow water table, but with soil conditions otherwise ideal for liquefaction, settlement can occur to some degree, depending upon the intensity of shaking and the looseness character of the soil. Such a compacting process would damage structures primarily where there is significant differential settlement within a short distance in alluvial valley areas, or where a site was partially on bedrock and partially on a fill or surficial earth materials. This phenomenon is of primary concern in those areas of Laguna where the underlying fill or surficial material is loose and can become saturated or where foundation conditions vary greatly within one lot or between adjoining sites. For example, one portion of a lot may be on sound bedrock and another portion on unsafe slide debris, thick residual soils, or loose fill.

Tsunamis and Seiches

Tsunamis are seismic sea waves generated by large submarine earthquakes, volcanic eruptions or large submarine landslides. Seiches are stationary oscillations of enclosed or partly enclosed bodies of water caused by landslides, sudden changes in atmospheric and wind pressure or earthquakes. Only seismically induced seiches are considered a potential hazard. The tsunami hazard is considered to be low for the elevations above the principal sea cliffs in Laguna Beach. Areas on the beach or below this sea cliff are considered to have a moderate tsunamic hazard, depending on tidal conditions and their elevation with respect to sea level.

The Army Corps of Engineers has estimated a 7-8 foot potential run-up for the coastal area. Assuming a coincidental highest tide, areas below the 16-17 foot contour level could be inundated by a tsunami. The chance of this occurring appears to be low based on existing data; but if an earthquake happened along the Newport-Inglewood fault, a tsunami of a much higher inundation level could be expected.

Policies

- 3A. Require a soils and geology report to be prepared and filed for all development projects as specified in the City's Municipal Code.**
- 3B. Require geological surveys to be prepared after onsite borings or subsurface explorations at the time subdivisions are submitted to the City for approval.**
- 3C. Require supervision by a state licensed soils engineer for grading operations which require a grading permit.**
- 3D. Maintain and enforce bluff and hillside protection measures which address control of runoff and erosion by vegetation management, control of access, site planning for new development and major remodels, including directing water to the street and compliance with blufftop setbacks.**
- 3E. Restrict development projects that will cause hazardous geologic conditions or that will expose existing developments to an unacceptable level of risk until the causative factors are mitigated.**
- 3F. Require independent review of the geologic and soils reports as appropriate.**
- 3G. File and reference copies of pertinent site-specific geologic information and index the information in the City's Geographic Information System.**
- 3H. Provide ongoing maintenance and inspection of all public drainage facilities and eliminate or mitigate uncontrolled storm drain flow on hillsides or bluffs. Provide for periodic notice to landowners encouraging the maintenance of private drainage structures to reduce the potential for saturation of the hillsides in developed areas.**
- 3I. Require the use of drought-resistant vegetation with deep root systems where appropriate for safety reasons in new development projects to reduce the potential for over-irrigation in the major canyons, high terraces and bluffs of the coastal fringe areas. Encourage the use of drought-resistant vegetation throughout the City through public education efforts.**
- 3J. Maintain the present City practice of adopting the latest edition of the Uniform Building Code (as amended and published by the International Conference of Building Officials at approximate three-year intervals) because it incorporates the latest accepted standards for seismic design that reflect advances in technology and understanding of hazards.**

- 3K. Prohibit the location of new essential facilities such as hospitals, fire and police stations, emergency centers and water tanks in geologically hazardous areas unless it is determined that there is no feasible alternative and the hazard is adequately mitigated.**
- 3L. Require that earthquake survival and efficient post-disaster functioning be a primary concern in the siting, design and construction standards for new essential facilities.**
- 3M. Evaluate the long-term risks and their associated costs versus the costs of relocation when major improvements to existing essential facilities are proposed and the facilities are located in known hazardous areas. Relocate the facility if the analysis indicates this is more cost effective in the long term.**
- 3N. Determine the liquefaction potential of a site prior to development and require that specific measures be taken, as necessary, to reduce damage in an earthquake.**
- 3O. Promote the collection of relevant studies on fault location and history of fault displacement and liquefaction for future refinement of the geological information within and around the City.**
- 3P. Identify the effects of the most probable seismic event (Modified Mercalli intensity value VIII or more) on the infrastructure within the City.**
- 3Q. Incorporate information on the probable seismic event impacts on infrastructure into the development of capital improvement programs so as to upgrade the survivability of the infrastructure.**
- 3R. Work with governmental agencies (i.e., CALTRANS and Water Districts) and the public utility companies to identify and promote effective mitigation of the effects of the most probable seismic event on the infrastructure which supports the City of Laguna Beach.**
- 3S. Prepare a Geological Hazards Map based on a study of the geological formations and hazards of the entire City, including the annexed areas of South Laguna and Laguna Canyon employing a format compatible with the City's GIS mapping system.**

- 3T. Integrate the latest information about earthquake survivability into the City's public safety education program. Encourage the retrofitting of every home within Laguna Beach for earthquake survival, especially in the area of adequate anchoring (tie-down) of the homes to their foundations.**

TOPIC 4: FIRE HAZARDS

California experiences large, destructive wildland fires almost every year. In October and early November of 1993, 26 major fires burned more than 200,000 acres in Southern California. The potential for a severe wildfire to occur is increased when dense vegetation growth and large accumulations of dead plant material are present. Weather conditions and steep terrain also increase the hazardous wildfire potential; however, these conditions do not cause wildfires. Human error, arson, high-voltage lines, vehicles and lightning are the primary causes of wildfires. Moreover, an expanding population seeking living space and recreation in the fire hazardous wildland contributes to the problem. The City of Laguna Beach, typifying the conditions throughout the State, faces a serious threat of wildland fires annually.

Structural fires, which typically involve only a single structure, are the most common fires that are battled routinely by local fire departments. Some of the common causes of structural fires are arson, electrical problems, combustibles too close to heat sources, unattended cooking and misuse of smoking materials. The combination of building materials, density, fire flow, hydrant location, response time of emergency equipment and natural conditions can exacerbate potential structural fire disasters.

Fire Hazard Severity Classification System

There are three levels of fire hazard zones within the wildlands surrounding the City. These zones are adapted from a fire hazard severity classification system for California wildlands developed by the State of California Department of Forestry. These classes are moderate, high and extreme fire hazard. This classification utilizes field investigation and present topographical information to define the fire hazard classes based upon three criteria: (1) Fuel Loading; (2) Fire Weather; and (3) Slope.

Fuel Loading includes three classes. **Light fuels** represent flammable grass and annual herbs. There are only a few areas in Laguna Beach which fit this category. Most of these have been altered by man's actions: cattle grazing, fuel breaks, etc. **Medium fuels** include brush and other perennial shrubs less than six feet in height with a crown density of 20 percent or more. This comprises the largest group in Laguna Beach, with the coastal sage scrub and chaparral plant associations dominating this group. Plants include: *Rhus integrifolia* (Lemonade Berry), *Rhus laurina* (Laurel Sumac), *Artemesia Californica* (California Sagebrush) and *Eriogonum Fasciculatum* (California Buckwheat). **Heavy fuels** are the heavier brush species, woodland types and timber types over six feet in height with a crown density of 20 percent or more. In Laguna Beach these areas are predominately located on north facing slopes in the canyons where the moisture content is greater. Plants in these areas include: *Quercus agrifolia* (Coast Live Oak), *Rhus trilobata* (Poison Oak), *Heteromeles arbutifolia* (Toyon). In Bluebird Canyon there is a stand of *Eucalyptus globulus* (Blue Gum) that also fits this heavy category.

Fire Weather includes three classes. Each class is related to the frequency of critical fire weather days occurring in each of the State's Fire Danger Rating Areas over an eight to ten year period. (Fire Danger Rating Areas are wildland geographical areas having similar climate.) The **Low Class (Class 1)**, includes all those Fire Danger Rating Areas which have experienced fire weather in the very high or extreme ranges on an annual average of less than one day; the **High Class (Class 2)**, has an annual average of 1 to 9.5 days; and the **Extreme Class (Class 3)**, has an annual average of more than 9.5 days. Each United States Geological Survey topographic map in the State is keyed to one of the Fire Danger Rating Areas and assigned that area's critical fire weather frequency classification. Based on the above methodology, Laguna Beach has been classified as a **Class 2 Fire Danger Area**.

Slope is divided into four classes as part of the Fire Hazard Severity Classification Scale. The following classes are based on the slope: 0-9.9 percent, 10 to 19.9 percent, 20 to 39.9 percent and over 40 percent. Slope is recognized as having an effect on fire behavior similar to the effect of wind (i.e., an increase in slope produces an increase in the rate of fire spread). The system therefore assigns values to slope which modify the various fire danger indices accordingly.

Each class of fuel loading, fire weather, and slope is assigned a severity factor value. The values are multiplied in a matrix to produce a Fire Hazard Severity Scale. This scale is relative, that is, a fire occurring in an area determined to represent a moderate fire hazard will be less severe than a fire occurring in an area representing an extreme fire hazard. It is important to note that this information represents a synthesis and necessary generalization of more detailed information, and thus is not an exhaustive description of the vegetation, slope patterns, etc., that exist. Rather, it represents the interpretation/generalization of available information as it relates to suitability of development based on fire safety.

Wildland Fire Hazard Potential

Several factors affect the hazard potential one can expect from a wildland fire in any given area. These factors include topography, vegetation, climate, development patterns, access and fire fighting capabilities to the area. All of the factors combined to contribute to the devastating wildfire in Laguna Beach on October 27, 1993, which engulfed 16,682 acres, destroyed 366 homes (286 homes within the City Limits) and damaged 642 homes.

Topography

The topography of Laguna Beach can best be described as being dominated by hillsides and canyons. This topographical condition has considerable effect on wildland fire behavior and on the ability of fire fighters and their equipment to take action to suppress those fires. This topography also channels air flow, creating extremely erratic winds on the slopes and in the canyons.

Vegetation

Along with the local topography, marine influences play a significant role in shaping the fire hazard potential for the area. The topography and soils encountered in the San Joaquin Hills along with climatic conditions, predominately influenced by the Pacific Ocean, have contributed to the plant environment found in Laguna Beach: coastal sage scrub and, to a lesser extent, chaparral and grassland. If the vegetation in the wildland areas is not periodically burned, the fuel load can create hazardous conditions. Other forms of fuel density control are grazing programs and fuel reduction by machinery and by the use of hand crews.

Climate

Climate is the single most important contributing factor to the fire problem. The Santa Ana winds are a phenomenon caused by very dry and warm air originating from high-pressure systems over California, Utah and Nevada. Winds can reach up to 70+ miles per hour and have a humidity of near zero. Precipitation (its annual total, seasonal distribution, and storm intensity) has further effects on the moisture content of dead and living vegetation and hence has important effects on fire ignition and behavior potential. Precipitation in Orange County averages between 9 and 15 inches per year and generally falls during the period from November to April. Most of the large fires occur during the fall, following abnormally wet winters.

The wind is a separate factor once a large brushfire has begun. It drives the fire before it, increasing the rate of spread downwind in proportion to its velocity. Passing through and beyond the fire, it then becomes a super-heated current of air which can move downhill rapidly and uphill many times faster, especially when funneled by the shape of gullies and canyons. Where the wind and topography combine to direct such an effect, the heat can be so intense that temperatures may reach 2400 to 2600 degrees. A strong wind can also carry burning debris, igniting many spot fires, often times from one-half mile to a mile downwind.

If enough area is ablaze simultaneously, the updraft from rising heat can generate a vortex or tornado which can lift up and propel firebrands over a wide area outside the original fire, which can then rapidly expand. The updraft can generate an unbalanced condition on uneven terrain which presses the flames against any nearby steep slopes, igniting them. Therefore, even in the absence of any prevailing wind, the fire can generate fire whirls which may move uphill with great rapidity. Auto-generation effects can arise because of the fire itself, if it is sufficiently large. These are usually referred to collectively as a firestorm.

Development Patterns

Development patterns can have considerable effect on fire ignition and rate of spread. This is especially true in the open space interface areas where the presence of man near the highly flammable brush creates a critical situation.

Building design and material, small lots, and the resulting proximity of adjacent structures compound the potential impacts of structural fire. When these combine with the threats of brush fires, fire hazards reach critical concerns. Some of the following neighborhoods have been identified as having critical development patterns with respect to fire are: Arch Beach Heights, Diamond/Crestview, Canyon Acres, Woodland/Milligan, the Olympic Village section of Upper Bluebird Canyon and the interface areas of South Laguna. Development patterns also affect the potential for fire hazard; high-density development, small setbacks, narrow roads, long cul-de-sacs and circuitous circulation patterns all work to reduce the effectiveness of fire fighting efforts. In addition, small setbacks and flammable building materials, especially within proximity to wildlands, tend to increase the propensity for fire and accelerate its spread.

The most significant factor determining overall fire risk is human proximity. The human element is often responsible for the ignition of major brush fires, as evidenced by the abundance and frequency of burns in the vicinity of residential neighborhoods. Unsupervised children, wood burning fireplaces, increased recreational use of the wildlands (off-road vehicles) and arson all contribute to the largest single source of wildland fires - man.

Access

Any discussion of access must simultaneously be concerned with egress, as well as ingress. Title 21 of the Laguna Beach Municipal Code "Plats and Subdivisions" sets forth standards for roadway development. As a result of early lifestyles and concomitant developmental patterns numerous neighborhoods are presently served by roads which do not meet Title 21 requirements.

The upgrading of these roads to conformity is not, in certain areas, feasible or desirable. For the purposes of hazard identification, the Fire Department has established a minimum unobstructed roadway width of twenty feet.

For a variety of reasons streets which fail to meet fire department minimum requirements for access restrict emergency mobility in the neighborhoods they serve. Among other reasons for road width inadequacy are illegal parking patterns, a non-dedicated usable vehicular right-of-way, and an insufficient fire department turn-around. Long cul-de-sacs (over 750') with inadequate vehicle turn-around also create special problems. Situations where personnel and equipment may be trapped, unable to reach the fire or flee from its path, are untenable. The City Council directed the Fire Department to identify and mitigate those areas with only a single access to and from the community. By providing a second access roadway, movement of fire apparatus can be deployed as evacuation is taking place. Deployment of fire fighting equipment is critical to successful fire defense of any community.

Fire Fighting Capabilities

The City of Laguna Beach is presently served by four fire stations. An automatic aid agreement provides for Orange County response into the fringe areas of the City for fire protection. Truck company service is also provided by the County on all structural fires. At least two Orange County Fire brush engines respond on all reported brush fires. The Laguna Beach Fire Stations are strategically located to provide optimum response times to most of the City. When the response models were developed it was realized that four fire stations would serve the City in a very effective manner. Response time (the time it takes to drive to the site after leaving the station) averages were calculated and found to be between 3 and 5 minutes in all areas studied within the City (except in the Club Laguna and El Toro area which is 5 minutes, 43 seconds.) A boundary drop agreement lessens the response time to just over 3 minutes. Total reflex time (time from receiving the call to site arrival) is around 7 minutes, where the driving response time is 5 minutes or less as outlined above and if the unit is a first response unit.

The following equipment is currently housed at the following locations:

- Fire Station #1 - One Type I engine and one utility vehicle.
- Fire Station #2 - Two Type I engines, one paramedic squad, one utility vehicle and one brush engine.
- Fire Station #3 - One Type I engine.
- Fire Station #4 - Two Type I engines and one brush engine.

The Fire Department is currently staffed by 3 fire fighters at each station for a total of 12 on duty per shift. The Department is augmented by an authorized cadre of 15 to 20 reserve firefighters.

Currently the Fire Department responds to about 120 structural fires each year. Events which involve one average structure are easily handled by four engine companies. Much of the response area of the City is adjacent to the wildland. The Laguna Beach Fire Department, as part of its resources, has two brush engines which will be equipped with Class A foam for wildland fire fighting. Additionally, the Type I engines will be outfitted with Class A foam within a year to conform to state-of-the-art standards.

Local Programs and Legislation

As experienced by the City of Laguna Beach in October, 1993, the Mutual Aid system works very well. However, mitigation measures must be implemented to ensure that the vulnerability to wildfires is reduced. The success of increasing public safety regarding fire hazards relies on systematically fighting the threat of fire **before** the fire occurs through a host of programs.

These programs include amending building codes, initiating controlled burns, developing guidelines for the placement and location of fire hydrants, developing landscape guidelines, defensible space management on a city-wide basis, enhancing the fuel modification program and analyzing the water system for fire fighting use. In February of 1994, the City Council adopted several staff recommendations to lower the risk of wildfire in the City of Laguna Beach. These areas of risk and necessary modifications are discussed in the following sections.

The City of Laguna Beach Fire Department participated in preparing a Report of the Wildland/Urban Interface Task Force. This report was compiled in response to the disastrous wildfires that struck Orange County in October of 1993. Recognizing that steps must be taken to preclude a reoccurrence, a multi-agency task force was convened and charged with addressing the issues relevant to the wildland/urban interface. The report, which has been endorsed by the Orange County Fire Chiefs' Association and has the support of the Building Industry Association, contains recommendations that have been tied to very high fire hazard severity zones, as applicable. The report contains a wildland hazard reduction inspection program, proposed amendments to the Uniform Building and Fire Codes, fuel modification guidelines for high fire hazard areas, a wildland fire management planning model and model ordinance and resolutions.

Building Codes and Landscaping Guidelines

The Fire-Zone Mapping Bill, (Assembly Bill 337 - the Bates Bill), requires the identification of fire zones within the 15 most vulnerable counties within California based on fuel load, weather, slopes and housing density. As a result of this Bill, the City of Laguna Beach will amend the fire severity zones to reflect the Bill's intent. The entire City is designated as being in the **Very High Fire Hazard Severity Zone**.

Wildland fires have demonstrated the need for fire-resistive building construction requirements in the wildland/urban interface zone that are more restrictive than the provisions in the Uniform Building Codes (UBC). The City of Laguna Beach has adopted special building requirements in its hazardous fire area (wildland/urban interface zone) that exceed the UBC requirements.

After the fire in Laguna Beach on October 27, 1993, a task force was established to determine if changes should be made to the Municipal Code to require homes to be even more fire-resistant in the hazardous fire area. Based on the task force's recommendations, the City Council recommended the use, where possible, of fire-resistive construction to resist fire spread. The Community Development Department has a list of fire-resistive components which can be used in new construction or in retrofit situations. Noncombustible roofs, double- and triple-pane glass and stucco-wrapped horizontal and vertical projections are examples of recommended fire resistive components.

The Fire Department must also develop, implement and maintain a community and neighborhood hazard identification and abatement program to support defensible space management. Defensible space is the private property, usually landscaped, which is managed in such a manner that the ornamentals or native plants do not increase the fuel loading in relation to structures.

Fuel Modification Program

Through sound management of the vegetation and planting at the urban wildlands interface it is possible to increase moisture content and reduce fuel loading, thus moderating potential fire hazard. The process of changing the moisture content by adding irrigation or planting moisture-retentive plants and reducing the volume of shrubs and woody debris by thinning and removal is termed fuel modification. Thinning and removal can be accomplished by the use of hand crews or by a combination of manual removal and grazing. The City has used both methods to maintain fuel modification zones. In the past cattle grazed the Irvine and Moulton Ranches to the north and east; and in recent years the City has contracted with herders to have goats graze vegetation in planned bands between homes and naturally vegetated areas.

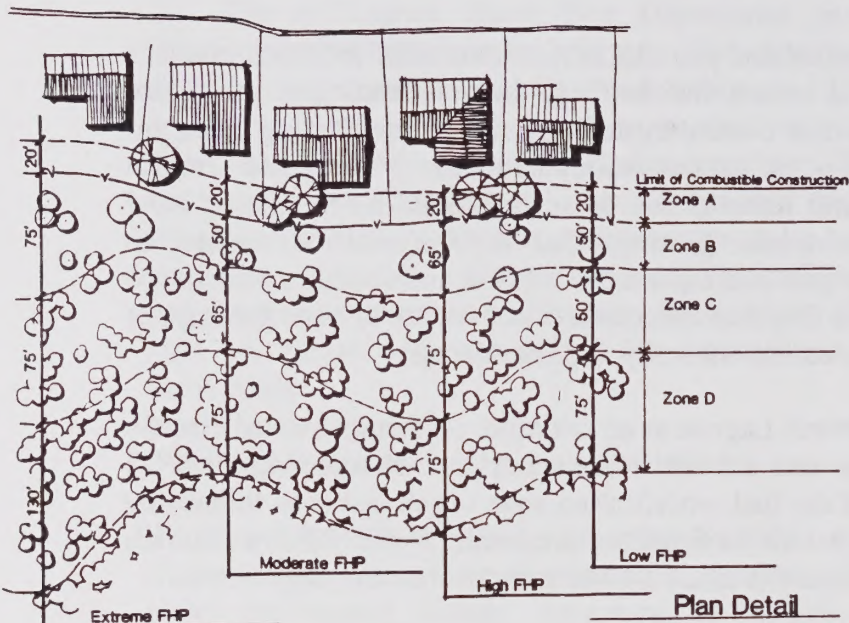
Fuel modification can be effective, with North Laguna as an example. Although located directly in the path of the fire, the North Laguna area did not suffer heavy loss of homes in the 1993 firestorm. This may be partly because of the fuel modification zone which had been thinned by supervised goat grazing one to two years before the firestorm occurred. These hills are also rich in moisture-retaining beavertail cactus, which is much slower to burn than dry sage scrub.

A typical recommended design for fuel modification zones is illustrated in Figure IV-1. The design shown in the figure consists of four zones varying in degree of modification between the structure and the unmodified natural vegetation. Management within these zones includes planting water-retentive, low-fuel shrubs and ground covers, adding irrigation, and doing graduated selective thinning of the vegetation to control the heat and intensity of wildland fires. Combustible structures such as decks, sheds, gazebos and wood fences should not be placed in any of the zones.

Balancing fire safety with protection of the native vegetation means that the width of the fuel modification zone must be weighed against the amount of vegetation to be removed. In general, if the fuel modification zone is kept very narrow, most of the vegetation will have to be removed. Conversely, a wider fuel modification zone will allow more of the vegetation to remain. A fuel modified area should be no less than about 200 feet wide due to flame tongues that alone can reach 200 feet during severe fire weather. The intent is that the width of the fuel modification area not be a set distance, but that it should be undulating in response to slope steepness and fire hazard potential.

Figure IV-1

Fuel Modification Exhibit



ZONE A - (minimum of 20 ft. wide)

The purpose of this setback is to provide a defensible space for fire suppression forces and to protect structures from radiant and convective heat. This part of the fuel modification program is closest to the home. It is relatively flat and is typically the rear portion of the home's irrigated landscaped garden area.

ZONE B - (50 ft. to 75 ft. wide)

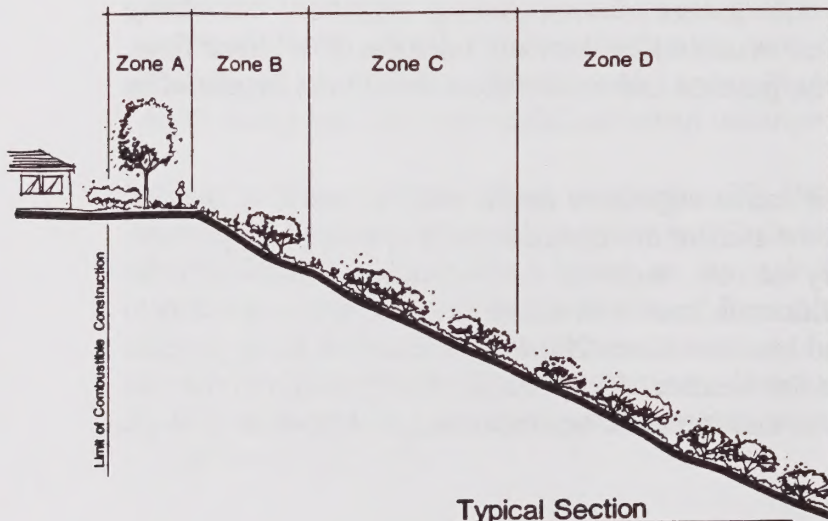
This is typically an area steeply sloping away from the home. It should be irrigated and planted with drought-tolerant, deep-rooted, moisture-retentive plants. Most of the native plants should be removed, although specimen shrubs could be thinned and preserved, if they were spaced away from continuous shrub masses.

ZONE C - (50 ft. to 75 ft. wide)

Further down the slope, this zone is not irrigated. Plants considered to be highly flammable (such as buckwheat, sage and sage brush) are removed. Other shrubs in this zone are thinned and cleaned of dead wood. Some may be removed in order to attain spacing between shrubs. Removal and extent of thinning is graduated with maximum amount done adjacent to Zone B and a lesser amount adjacent to Zone D. Removal is approximately 50% in Zone C, although percentages of removal would be recommended on site by the Fire Department depending on the conditions and type of vegetation.

ZONE D - (75 ft. to 130 ft. wide)

This is similar to Zone C, but with fewer shrubs being removed. Removal and thinning would typically be approximately 30% adjacent to Zone C, graduating to no removal at the farthest extent of the Zone.



The canyon and hillside areas classified as high hazard areas often contain sensitive native vegetation, including endangered, rare and locally important plants and animal habitat. Consequently, fuel modification programs must include measures to balance fire safety and protection of sensitive plant species and habitat for rare, threatened or endangered wildlife species.

To accomplish the objectives of maintaining fire safety while protecting sensitive native vegetation, slope stability and the integrity of natural areas, a fire protection program should incorporate a combination of the following:

- fire-resistant building materials;
- minimizing combustible materials (including plantings, decks, fencing and firewood) around the home;
- setback of combustible construction from the wildlands area;
- irrigated buffer zones; and
- fuel modification zones.

By employing a combination of all of these prevention techniques (rather than relying on vegetation removal alone), a higher level of safety can be achieved, the quality of natural areas can be preserved and risk of erosion and slope stability can be minimized.

Annual maintenance of pruning and removal of dry and dead materials is needed to assure that the fuel modification areas continue to provide an area of reduced fire hazard.

Fuel modification can occur on private or public land, but modification performed by private property owners cannot go beyond property lines without agreement by the adjacent property owners. In cases where fuel modification is needed on public land, a fuel modification easement can be granted to the adjacent private party assigning the private party maintenance and liability responsibility.

While in most areas of the City with existing homes the concepts of fuel modification must be applied to remedy, as much as possible, a less than ideal situation, owners of undeveloped properties and lots should conduct site planning from the beginning of project design to create proper zones and setbacks, and to site structures at the safest locations in terms of fire danger. Responsibility for the continued maintenance of fuel modification areas also needs to be defined and structured.

In 1963 Orange County initiated a fuel break program, and as a participant, the City of Laguna Beach took remedial action to address this persistent problem area -- the natural resource (open space)/urban interface. The City Council has since directed the Fire Department to implement a program, supported by the proper funding mechanisms, to widen existing fuel modifications and extend the program into the southern-most border of South Laguna and to install/construct

fuel breaks in the interior canyon areas of Park Avenue/Hidden Valley, Rimrock Canyon, Bluebird Canyon, Diamond/Crestview and Oro Canyon. The City will be working with the Coastal Greenbelt Authority, the City of Laguna Niguel and respective neighborhood associations including Emerald Bay, Laguna Sur and Monarch Point and the Orange County Harbors, Beaches and Parks Department to support more aggressive wildland management techniques which will provide younger fuel beds, support less flame intensity, and provide a mosaic pattern of different ages of fuels, all of which will help reduce wildfire exposure.

Planning and Maintenance of Outdoor Areas Adjacent to Homes

While fuel modification deals with the treatment of the urban/wildlands interface, the concept of defensible space applies to all areas of the City. Creation of defensible space means the arrangement of access on the property for ease of fire fighting and maintenance of properties to minimize buildup of fuel that could ignite and cause fire to spread to the home.

Better access for fire fighting should include the following:

- providing safe walkways around all sides of the house; and
- keeping side yards unobstructed and free of flammable stored items.

Maintenance for fire safety should include the following:

- thinning of planting to remove dead wood and to reduce build-up of branches and foliage;
- removal of dried leaves and grasses, dead limbs and twigs, and chipping, composting and mulching planting areas where feasible;
- spacing and pruning of trees and shrubs to avoid continuous canopies and "fuel ladders" from ground to canopy;
- removal of plants growing up under eaves;
- pruning of tree branches and shrubs within ten feet of a chimney;
- removal of leaves, pine needles and debris from roofs and rain gutters;
- removal of combustible stored material and debris from around and under the house and decks; and
- stacking of firewood as far away from the home as possible.

When planning the landscape of a home, access for fire fighting should be considered in the design. Maintenance considerations outlined above should be considered in the choice and placement of plantings. Adjacent to the natural vegetation areas, construction of combustible structures--fences, decks, and gazebos should be minimized. Wood decks with open areas underneath should be enclosed to reduce potential for ignition from fires below.

Planting and Fire-wise Plant Choices

While much has been written and suggested regarding fire-resistant or fire-retardant plantings, the 1993 fire demonstrated that any plant will burn. However, reasonable planting selections combined with sound arrangement and spacing and good maintenance can improve the chance that a structure will survive a wildlands fire. Lists of suggested and not-recommended plants for the wildlands interface zone have been prepared by many public agencies, including the Orange County Task Force, County of Los Angeles Fire Department and the City of Oakland, as well as by the garden publications. The County of Orange Report of the Wildland/Urban Interface Task Force, July 1994, also includes a recommended plant list for fuel modification zones. A comparison of these often conflicting lists reveals certain criteria for fire-wise planting as follows:

- Low fuel volume;
- High moisture content;
- High salt content;
- Low aromatic oil content;
- Low heat value;
- Minimal production of dry litter; and
- Suited to the site and climatic conditions so that plants will be healthy.

Consistently "not-recommended" plants include conifers--pines, cypress, cedar and junipers. Also "not-recommended" are acacia, bougainvillea and ornamental grasses. Eucalyptus is also "not-recommended" on many lists because of the high aromatic oil content and the tendency of some species to produce high amounts of dry litter. The use of "not-recommended plants" should be avoided adjacent to natural vegetation areas.

Because of Eucalyptus's dominance in the landscape of Laguna Beach, it is important to look at this genus in more detail. There are over 700 species of Eucalyptus, and they vary greatly in their size, fuel volume and litter production. An unmaintained Blue Gum, for example, has a great deal more flammable material in its shedding bark, leaf litter and branches than a Lemon Gum. Many of the Lemon Gums survived the 1993 fire with some charred trunks and loss of foliage. The County of Orange Report of the Wildland/Urban Interface Task Force did not single out or condemn Eucalyptus. It emphasized irrigation, thinning and spacing as keys to any fire-safe landscape.

Irrigation, thinning and clean-up to keep the amount of litter and dried materials low, arrangement and spacing to avoid continuous canopies, and keeping foliage away from structures are as important as the type of plants chosen.

Weed Abatement

The City of Laguna Beach has had a weed abatement program for over thirty years. Property owners are notified when property they own is determined to be a weed nuisance. They then have the option of either abating this problem themselves or having the City do it and bill them for services rendered. In recent years the City has had this work performed through contract services. This program addresses only weed abatement and generally does not address native plant material that may be growing adjacent to an urbanized area.

Water System

The water districts which serve the City of Laguna Beach import all of their water from the Metropolitan Water District of Southern California (Met). The sources of Met's water include northern California and the Colorado River.

Three water transmission lines currently bring water into water districts which serve the Laguna Beach area. One line, under Pacific Coast Highway, starts in Corona del Mar and terminates at the Laguna Beach County Water District's (LBCWD) San Joaquin Reservoir on Ledroit Street. The second line begins in Irvine, runs through Laguna Canyon and terminates at LBCWD's Moorhead Reservoir above the Art Festival grounds. The third line enters the Laguna Beach area from the south along Pacific Coast Highway through South Coast Water District (SCWD). A fourth line located between the proposed Top of the World Reservoir and the Ridge Reservoir is anticipated to be completed in 1995-96.

Once the water has entered the Laguna Beach area, it is either stored in reservoirs at lower elevations or pumped up into other reservoirs at higher elevations. The maximum elevation that water can be stored in the Laguna Beach area without being pumped is 400' above sea level.

The amount of water required for extinguishing a single structure fire can be calculated by using a complex formula that takes into account the building type, building construction materials, building area, material types stored inside the building and the surrounding terrain. After the October 1993 firestorm, it became clear that a fire of that magnitude taxed the water supply and delivery system beyond its design capability. In order to maximize the defensibility of interface areas within the City, the City should continue to work with the Water Districts, in conjunction with the Fire Department, to analyze these aspects of the water system for fire fighting use.

Policies

- 4A. Ensure that adequate facilities and fire service personnel are maintained based on population, fire hazards in and around the City and a performance standard of an average total reflex time of seven minutes or less.**
- 4B. Review and continually maintain each year the City's fuel modification program.**
- 4C. Work with adjacent local jurisdictions and agencies on the ongoing implementation of the City's fuel modification program.**
- 4D. Coordinate the City's fuel modification program with neighborhood associations.**
- 4E. Work with governmental jurisdictions and agencies on the cooperative, integrated implementation of the Orange County Report of the Wildland/Urban Interface Task Force's recommendations.**
- 4F. Develop a funding mechanism which has a long-term viability of providing for a relatively continuous, adequate revenue stream to fund the City's fuel modification program.**
- 4G. Educate and inform the public on fire safety, especially regarding landscaping installation and maintenance in urban areas, to further protect the community and the environment from unnecessary fire hazards.**
- 4H. Require that new development located within wildland interface areas reduce the threat of wildfires through fuel modification, fire resistive construction and defensible space management consistent with the following Fuel Modification Guidelines and in compliance with the Fuel Modification Exhibit (Figure IV-1):**
 - (a) Prohibit combustible structures, including but not limited to wood decks, sheds, gazebos and wood fences, within the 20-foot minimum width of Zone A.**
 - (b) Require irrigation systems to be installed and operated within Zone A to ensure a reasonable moisture content in planted areas.**
 - (c) Discourage the planting of trees and vegetation which produce excessive fuel or litter within Zone A.**

- 4I. Enhance the ability of all structures within the City to resist both wildland and structural fires through ongoing, appropriate and cost-effective changes to the City's Zoning, Building and Fire Codes and standards.**
- 4J. Work with the Water Districts to analyze the supply and delivery aspect of the water system for fire fighting use to help identify and correct deficiencies.**
- 4K. Develop an early warning system of wildfire dangers to alert the public of possible precautions or safety measures that may be taken during those critical times.**
- 4L. Develop a perimeter fire prevention signage program with adjacent cities and jurisdictions to alert the public of the wildfire dangers.**
- 4M. Locate access roads, trails or fire roads within the fuel modification areas where feasible to minimize the removal of native vegetation.**
- 4N. As a condition of new development, require private responsibility for development and maintenance of fuel modification zones and programs, including a recorded deed restriction acknowledging the fire hazard potential and maintenance responsibility by the developer or his successors and assigns.**
- 4O. Encourage property owners to create defensible space surrounding their homes, including providing access for firefighters, maintenance of plantings and outdoor areas and minimizing combustible structures.**
- 4P. Encourage property owners to consider "fire-wise" planting, especially in landscapes in areas adjacent to the wildlands interface.**

TOPIC 5: FLOOD HAZARDS

Historically, flooding has been beneficial to agricultural soil, wildlife and the general ecological balance. In the unaltered state, water systems have considerable built-in capacity for detaining storm waters that would otherwise surge too rapidly downstream and into estuarine basins. Hydrologists emphasize that, along natural watercourses, flooding is a routine process. Flooding in an urban setting can also be viewed as a natural hazard.

Virtually all stages of the natural hydrologic cycle, including flooding, have been significantly altered by human intervention. Changes in land use have profound effects on runoff and erosion on the land surface. As vegetation is removed and soil is exposed during construction, erosion rates may increase significantly. The creation of impermeable surfaces that accompany urbanization increases and concentrates runoff, leading to a greater incidence of flooding.

A flood may be defined as a temporary rise in stream flow that results in water overtopping its banks and inundating areas adjacent to the channel not normally covered with water. The lowland area adjacent to the stream that is subject to periodic inundation by floodwater is known as the floodplain.

The magnitude of a flood is measured in terms of its peak discharge, which is the maximum volume of water (in cubic feet per second) passing a point along the channel. Floods, however, are usually referred to in terms of their frequency of occurrence. For example, the 100 year flood is a flood magnitude which has a 1% chance of being equaled or exceeded in any given year. There is a certain element of risk involved using this type of designation because the prediction of a flood of a particular magnitude is based on probability and an element of chance is involved. According to statistical averages, a 25-year flood should occur on the average once every 25 years. However, two 25-year floods could conceivably occur in any one year. For planning purposes the flood magnitude most often used in delineating floodplain boundaries is the 100-year flood. This flood is also referred to as the *intermediate regional* or *base flood*.

The climate of Laguna Beach is typically Mediterranean, characterized by warm, dry summers and cool, rainy and foggy winters. The average annual rainfall is 13 inches. Over 90% of this rainfall occurs between late October and early April.

Flooding is a direct response to the amount, distribution and intensity of precipitation. Most surficial hillside damage is brought by sudden deluges of already soaked ground. Storms that combine high total rainfall, long duration and high daily maxima, as in the 1969 storm, are the most destructive. Heavy runoff and accelerated erosion are associated with this type of short-period torrential rain, as well as with storms of longer duration and greater totals.

Historically, floods causing significant structural damage have occurred in Laguna Canyon in 1937, 1938, 1941, 1966, 1969, 1978, 1983 and 1995. Flood potential does exist in the form

of temporary flash floods related to winter rains and wave runup. Most of the flash flood activity is isolated along the canyons, the floors of which act as runoff channels for the watershed above. With the exceptions of Laguna, Bluebird and Aliso Canyons, most flash flood conditions in Laguna Beach are short lived in nature due to the limited size of the available watershed and the presence of drainage improvements. Drainage resulting from flash floods is more erosive than inundative in nature.

In general, three separate and distinct types of inundation are known to exist in Laguna Beach. Flood inundation hazards are those associated with major atmospheric events that result in inundation of developed areas, due to overflow of nearby stream courses, or inadequacies in local storm drain facilities. Facility inundation hazards are those associated with downstream inundation that would occur given a major structural failure in a nearby impoundment. Such failures would most likely be caused by geologic phenomena including seismic events and slope instability. The third inundation hazard is mud and debris flow that may occur during the rainy season.

Sections of Laguna Beach are subject to flooding due to *wave runup*. This type of flooding is typically caused by large swells produced by storms at sea occurring at high tide. Approximately every 10-15 years, waves wash up on Pacific Coast Highway between Broadway and Ocean Avenue. Wave runup is especially damaging to the residences located on Victoria and El Moro beaches. The water and debris left by the waves typically cause no damage to the commercial area, however, traffic is blocked along Pacific Coast Highway. Wave runup damage did occur in the downtown commercial area in 1929. In 1978, Main Beach Park suffered from wave runup and heavy sand deposition, and later that same year, several trailers at El Moro Beach were damaged due to wave runup.

Sedimentation is found where runoff, heavily laden with the products of erosion, undergoes a sudden decrease of velocity and can no longer transport its whole load. This is found usually at an abrupt decrease of slope, where any obstruction impounds the flow, or on bottomland during a heavy backwater flood. It is always proportionate to the amount of erosion taking place. Sedimentation presents a serious hazard to property located on a floodplain next to a natural streambed. It fills the bottom of the channel, reducing the carrying capacity until even a modest rainfall cannot flow by without overtopping the banks. Many residents have found that a heavy rainfall necessitates their patrolling the streambed during and just after the storm to remove any objects which could lodge and cause an obstruction and sedimentation.

A *mudflow* is similar to a flash flood in that the effluent sweeps down canyons, causing damage by its rapid motion. It differs in the abnormally high percentage of sediment it contains, sometimes over half. This adds to the bulk, velocity, erosive power and destructive ability of the runoff. The usual observation about mudflows is that the damage is far out of proportion to the storm which produced it. The causative factors are unique. They are: 1) steep terrain, stripped of vegetation by fire or other causes and mantled with a thick residual soil high in clay and silt, and 2) a series of storms which first saturate the topsoil and then deliver an intense

downpour to wash it away suddenly. Several areas of town experienced mudflows during 1969, in late 1993 and early 1994, after the October 1993 firestorm, and in 1995.

The magnitude and frequency of flooding can be influenced by many factors. The growth of brush and trees within the floodplain can act as an obstruction to floodwater flow. Flood heights may also be naturally increased by the occurrence of fire in a watershed followed by heavy rainfall. The increase in storm runoff and sediment decreases the ability of the ground to absorb additional moisture. Laguna Beach experienced this problem during moderate rains after the October firestorm.

The encroachment of urban development is perhaps the most serious change in drainage basin and floodplain characteristics that can influence the magnitude and frequency of flooding. Urbanization often leads to a greater percentage of impervious surfaces which increases the total volume of storm runoff by decreasing the amount of water that infiltrates into the ground. Development can also result in the placing of artificial fill and other objects in the floodplain.

To protect development from the impacts of flooding, stream channels are often channelized (straightened, lined, etc.) to move the water off of the land more efficiently. However, when water emerges from the improved section of stream channel, it is often delivered to the unchannelized downstream section at rates and velocities that the natural section of stream is not capable of carrying. Piecemeal channelization efforts often exacerbate the flooding potential downstream. Therefore, it is important that flood hazard reduction operations be comprehensive, well planned programs.

Local Setting

The City of Laguna Beach, Master Plan of Drainage was prepared in 1982, and the South Laguna Master Plan of Drainage was prepared in November of 1993. These documents identify the local network of flood control facilities and provide a basis for establishing funding mechanisms and prioritizing system improvements. These Master Plans are primarily based on existing conditions and facilities and anticipated land use to determine storm runoff. To continue to be effective, they should be periodically updated to reflect new hydrologic modeling techniques, revised rainfall runoff data, changed land use and development, and current costs.

The effects of storm water runoff in the City of Laguna Beach are not typical of problems in inland areas, where run off from several tributary areas combines to inundate low-elevation areas. Because the topography consists of a relatively long and narrow coastal plain backed by rugged terrain covered by brush, each drainage area is separate. Although many of these drainage areas are basically in an unaltered state, a majority of the lower reaches have been channelized.

Stream channelization involves straightening the natural meanders, clearing the banks and widening and deepening the channel. It is undertaken to assist in flood control and to increase developable land. Channelization lowers the level of the stream and the riparian water table, increases the rate of surface run off, increases the stream flow rate, enhances bank and bottom erosion, and transports a heavier sediment load than the unchannelized stream. Channelization also affects the beach replenishment process which is discussed in Topic 7, Shoreline Protection.

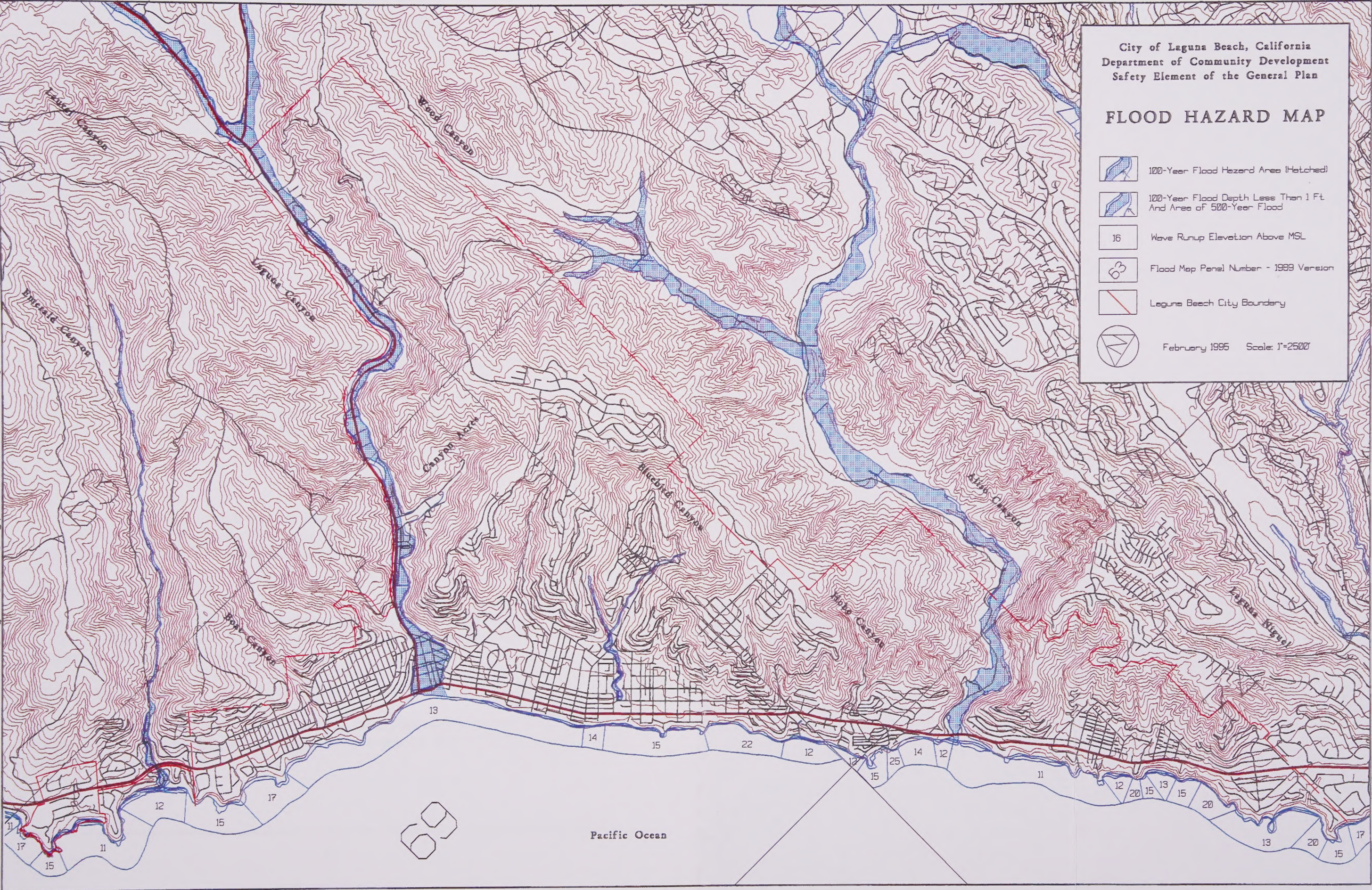
Laguna Canyon channel is a major watercourse through the City. The headwaters commence from a shallow lagoon located at the upper corporate limits approximately 5 miles from the Pacific Ocean. The drainage area of Laguna Canyon and its tributaries is about 8 square miles, including the east fork along El Toro Road and Canyon Acres wash.

Development in the floodplain of Laguna Canyon ranges from dense at the mouth to sparse toward the City's upper limits. The lower end of the canyon opens into the central business district of Laguna Beach. The floodplain in this area has been completely developed. Residential and light industrial development is predominant in the area between Woodland Drive and El Toro Road.

Boat Canyon and the lower reach of Bluebird Canyon are two other major watersheds that traverse the City's coastal shelf. Both Boat and Bluebird Canyons exhibit extensive urban development in the floodplains. Much of Bluebird Canyon and Boat Canyon are in a natural state, excepting the lower reaches which are piped.

With the exception of Laguna Canyon and South Laguna, watersheds in Laguna Beach vary in size from 2-3 acres up to 650 acres. Laguna Canyon watershed measures 5,000 acres and South Laguna encompasses approximately 1400 acres, extending into Laguna Niguel. Watersheds in the central portion of the City are typically located within the City Limits. Watersheds in the northern portion, including Laguna Canyon extend beyond corporate limits into other jurisdictions. Land use planning in these adjacent areas (Laguna Sur in South Laguna, Aliso Creek and Aliso Viejo on Laguna Canyon Creek) have a direct effect on storm run-off on the watersheds. (Refer to Flood Hazard Map.)

Note: Flood information digitized from Federal Emergency Management Agency publications. Not all areas subject to flooding are shown, particularly from smaller local drainage sources.



Flood Protection Measures

As part of the National Flood Insurance Program, a report was prepared which delineated floodways in Laguna Beach. The generation of this report and accompanying maps help illustrate where development has encroached into the floodway creating a hazardous condition.

A majority of the City's storm drain infrastructure, unless otherwise noted, is designed for the 25-year flood. It would, therefore, be inadequate for the more generally accepted standard of a 100-year flood. Several drainage improvements have been made within the City which include, but are not limited to:

Laguna Canyon Channel

The existing channel improvements extend from the ocean to the GTE Corporation maintenance yard in Laguna Canyon. The reach from the ocean outlet at main beach to Beach Street is owned and maintained by the City of Laguna Beach. Caltrans constructed the reach of channel from Beach Street to the boardwalk in 1928 as part of a Pacific Coast Highway construction project. North of the GTE facility, the natural channel meanders through private property and has historically been maintained by the property owners. Both the existing improved channel and the unimproved natural channel are incapable of conveying the 100-year discharge as depicted in Table II. The City is currently conducting an analysis of alternatives to improve public safety and reduce flooding hazards in Laguna Canyon and the Downtown area. The primary goal of this study is to control floodwaters by storing them in retention, detention and filtering basins, which drain out when the downstream storm drains are no longer overtaxed.

Boat Canyon

The Boat Canyon storm drain extends from Hillcrest Drive to the Pacific Ocean. The drain has been designed to carry the 100-year frequency storm, however, a high debris factor causes local flooding at the inlet at the rear of Riddle Field.

Bluebird Canyon

Bluebird Canyon has a graded greenbelt channel through its lower reach and a natural canyon in its upper reach. The storm drain from Glenneyre Street to the Pacific Ocean was designed to carry the 100-year frequency flood.

Hidden Valley Canyon

Hidden Valley Canyon has surface run off that runs down Park Avenue to Wendt Terrace. The Master Plan of Drainage proposes the extension of a pipe to Hidden Valley to resolve this problem.

Aliso Canyon

Aliso Creek is a natural unlined channel. The creek bed cuts through privately owned property.

Table II - Existing Drainage System Capacities in Laguna Canyon

Location	Estimated Capacity (cfs)	U l t i m a t e 100-year
Ocean to Forest Ave.	Varies 700 to 2000	7700
Forest Avenue to Canyon Acres Dr.	Varies 1200 to 2100	7500
Canyon Acres Dr. to 2900' U/S	1920 1840	6900
2900' U/S to 4,700' U/S of Canyon Acres Dr.	1840	6900
4,700' U/S Canyon Acres Dr. to GTE	2850*	6700
GTE to El Toro Rd.	300-400	6100
El Toro Rd. to SJHTC	300-400	2390**

*Inlet capacity 1840 cfs

** Q25

U/S = Upstream

Information obtained from a report on Laguna Canyon Drainage System Study by Boyle Engineering, 3/24/95.

Of the numerous other drainage facilities throughout the City of Laguna Beach, most drain areas are of insignificant size or have the capacity to pass the 100-year storm. The concept of 100-year protection remains desirable, but may not be achievable in the foreseeable future due to financial factors. Therefore, the concept of providing reasonable level of drainage control to meet the 10, 25, or 50-year design frequency should be considered while waiting for the ultimate, 100-year design to be designed and funded. Drainage structures that do not meet the

standards of the 25-year storm and/or drain areas of sufficient size have been noted in drainage studies.

In 1988 the City of Laguna Beach adopted a Flood Damage Prevention Ordinance to promote sound land use and floodplain development standards pursuant to the rules and regulation of the Federal Insurance Administration and Federal Emergency Management Agency. Areas of special flood hazard and areas of mudslide hazards have been identified by the Federal Emergency Management Agency on the Flood Insurance Rate Map (FIRM) which has been adopted by the City and is included as part of the Flood Damage Prevention Ordinance.

Water Quality Control

In 1990 the City, along with the County of Orange, the Orange County Flood Control District and the other Cities of Orange County (as Co-Permittees), were issued a National Pollutant Discharge Elimination System (NPDES) Stormwater Permit, as part of the implementation of the Federal Clean Water Act, by the Environmental Protection Agency (EPA) through the State of California and the State Water Resources Control Board. The NPDES Permit established two major requirements: 1) an effective prohibition of non-stormwater pollutant discharges into the storm drainage system; and 2) implementation of water quality Best Management Practices (BMPs) through the development and adoption of a Drainage Area Management Plan (DAMP). The BMPs help to effectively control erosion sediment from discharging into the stormwater drainage system.

Central to an effective prohibition of non-stormwater discharges is the enactment by local jurisdictions of ordinances preventing such discharges. In 1995, the Co-Permittees will be adopting such ordinances based on a model ordinance developed in 1994. In Laguna Beach the Water Quality Control Ordinance will replace Title 16 of the Municipal Code regarding Industrial Waste Disposal that was adopted in 1990. The new Water Quality Control Ordinance is intended to prevent industrial waste pollution, as well as other non-stormwater pollutant discharges, and all new development will be required to comply with the water quality management techniques as outlined by the Best Management Practices of the DAMP.

Policies

- 5A. Use natural watercourses as the City's primary flood control channels whenever it is safe to do so.**
- 5B. Periodically inspect and maintain all public drainage structures and remind property owners to maintain private drainage structures in order to maximize capacity.**
- 5C. Implement a public education program pertaining to flood hazards and ways in which citizens can protect themselves and their property.**
- 5D. Contain and utilize run off from impervious surfaces onsite to the greatest extent possible. Transmit excess run off to the nearest street or facility capable of conveying the run off without impacting downstream areas.**
- 5E. Minimize the threat of mudflows by implementation of proven and effective erosion control methods.**
- 5F. Plan capacity for the 100-year flood and provide short term reasonable protection for locations that would benefit from 10-, 25- or 50-year storm drainage facilities.**
- 5G. Consider the effects on beach sand replenishment of improvements to natural drainage channels.**
- 5H. Improve the existing flood control capacity in Laguna Canyon and consider flood protection measures that may include stream restoration, coordination of private efforts for improvements, flood proofing downtown and retention/detention basins.**
- 5I. Pursue a regional approach to watershed management and coordinate improvement plans with local, state and federal agencies, including all of the jurisdictions that make up the Aliso Water Management Agencies.**
- 5J. Update the Master Plans of Drainage to integrate the drainage systems of the entire City into one plan and include an implementation schedule and priorities for improvements.**
- 5K. Continue the practice of preventive maintenance, including storm tracking and proactive street and storm drain maintenance.**

5L. Monitor the affects of inland development on the City's watershed and its management and attempt to minimize their impacts.

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TOPIC 6: SHORELINE PROTECTION

The California coastline has been eroding for thousands of years. Erosion did not present economic or safety issues as long as the coastal areas were left undeveloped or were used for agriculture or low-intensity recreation. The desire for magnificent ocean views and convenient beach access has induced many people to build at the ocean's edge, even in high-risk locations. For such dwellings, each severe winter storm is a potential disaster. Coastal erosion is likely to continue or even to accelerate in the future.

Damage from storms and erosion are episodic in nature. The winter storm of 1982-1983 resulted in substantial losses to Orange County beaches. With continued coastal community growth and development, property values continue to increase. Costs from damage due to major storms could be greater each year as coastal land is increasingly upgraded and developed. Owners of oceanfront properties become more concerned with protecting their investment from storm erosion and structural damage. During and after severe storms, many oceanfront property owners attempt to construct protective devices that do not consider the complex interrelationships of the land and sea.

Over the years, the bluffs of the coast of California have been modified by the development of structures and through the use of irrigated landscaping. Seacliffs with weak geologic structures are typically prone to landsliding, rockfalls and surficial failures. Extensive grading, landscaping and irrigation can exacerbate this problem. Preventive measures are the most logical goal for the City. Prior to approving structures designed to retain the slope, drains, dewatering sublayers and modifying landscape and irrigation should be considered.

Seacliff retreat is a natural process. When considered over a long period of time, the seacliffs and beaches are retreating. This retreat is episodic, infrequent, site-specific, directly related to wave climate and rainfall, and is highly impacted by urbanization. The protection, preservation and restoration of sandy beaches and the desire of private property owners to protect their investments are closely interrelated. The value and enjoyment of oceanfront property depends, to a great degree, upon the existence of a sandy beach. As sandy beach widths are reduced, an increase in the amount of wave attack on beach front property and the base of the existing seacliff occurs.

Sand management is the act of controlling the littoral sediment resource, to the extent possible, to benefit the recreational and protective functions of a beach. It requires that changes in beach width be anticipated before they occur. Only then can enlightened decisions be made and cost-effective methods be implemented to deal with undesirable shoreline behavior.

Local Conditions

The Laguna Beach coastline is characterized by short, generally narrow sandy beaches separated by protruding headlands. The coastline retreated at an unequal rate as sea level rose about 400 feet in the last 18,000 years. Headland seacliffs of resistant rock did not retreat as fast as the more erosive seacliffs in the embayments. Beaches formed and are maintained in the embayments because there they are partially protected and contained by the headlands. The sand is held in the bay or compartment and the compartment functions as a closed sand system (sand moving parallel to shore) that can be managed separately from other coastal compartments. Sediment discharge from streams, particularly Laguna Canyon and Aliso Creek, could change and decrease the yield of sediment. Sediment yield is usually reduced as a result of maturing urban or suburban development. Channelizing streams, even small ones, can affect sediment discharged to the ocean. Therefore, streams should be left in their natural condition whenever possible. Future channelization projects should analyze this potential effect to the City's beaches.

In April of 1988, the City of Laguna Beach adopted Guidelines for Shoreline Protection, with technical data, prepared by Craig Everts of Moffatt & Nichol, Engineers. The primary objective of the Guidelines was to develop a better understanding of the localized shoreline environment, including its history, changes, and general performance. This document provides a mechanism for evaluating proposed alternatives for shoreline design factors and provides guidance as to their suitability for any particular application.

With only a limited number of exceptions, few residential and commercial structures in the City are exposed directly to ocean wave attack. Periodically, foundation materials are washed by waves which cause landward erosion and retreat and threaten long-term stability. In an ongoing effort to arrest this process and to develop the beach-front for recreational use, approximately 106 seawalls, bulkheads and foundation walls have been constructed in the City (excluding South Laguna). (A seawall or "shore protective device" is any bulkhead, retaining wall, revetment, fence, berm or other structure primarily designed to prevent erosion or other damage due to wave action.) Most of these improvements were constructed many years ago, before the City had specific standards and requirements for them. Excluding the bulkhead beneath the Main Beach Boardwalk, these structures extend to an aggregate footage of 4,981 lineal feet when added end-to-end. This amounts to one-third of the City's beach frontage, excluding South Laguna beaches, backed by some type of structural device. Many of the older reinforced concrete structures are in various stages of distress due to cracking, settlement and exposure of reinforcing steel. Many are inadequately founded and are being undermined by scouring during storms. Accelerated scour on either side of structures that extend seaward of the bluff can be detrimental to the adjoining owners. Other structures show a lack of maintenance, demonstrating the need for long-term upkeep to ensure continued functionality. Finally, location, construction materials and appearance oftentimes raise fundamental aesthetic questions (Everts 1988).

Shore protective devices have three potential undesirable effects. These are as follows:

- "1) A protective device constructed seaward of the base of the seacliff will be responsible for a reduction in beach width because the landward edge of the beach is artificially moved seaward.
- 2) A protective device may be responsible for a permanent loss of sand in the coastal compartment, and hence a reduction in beach width.
- 3) A protective device may be responsible for a temporary loss of beach sand which reduces the width of the beach. This may occur even though the volume of sand in the coastal compartment over a long period of time is not affected by the device."¹

Beach replenishment is an active management response to an imbalance in the sediment budget of a coastal compartment. Beach or sand replenishment could be an aesthetically attractive and economic alternative to the construction of hard shoreline protection devices. Beaches are very effective in dissipating wave energy. It is important to understand that sand replenishment cannot be expected to solve all shoreline problems, especially areas that are experiencing failures independent of wave attack. Nevertheless, the potential benefits of using a natural material such as sand for shore protection should be investigated. The development of a database could help to prepare for a long-range planning effort.

Knowledge of the natural and actual rates of shoreline erosion is important for planning purposes. Comprehensive studies of rates of erosion by oceanographers and marine geologists have not been done during past decades. The City of Laguna Beach is participating in a five-year study of the Orange County Coast. The cost is shared by the Federal Government and Orange County and five coastal cities, including Laguna Beach. The report began in 1991 and covers the portion of the Orange County coastline from the mouth of the San Gabriel River to the Dana Point headlands, approximately 32 miles. The product of this report will provide a database of sediment type, movement and location, wind, currents and wave height and frequency that will establish a "normal" condition. A primary goal is to provide comprehensive coastal data and information in a format that helps coordinate and enhance the efforts of federal, state and local agencies involved in managing and maintaining valuable coastal resources. Such information can be invaluable in designing beach nourishment projects and in preparing oil spill contingency plans, both of which are regional issues. The study will provide an opportunity for commencing a regional benchmark investigation and will enable the City to comply with recommendations relative to "resource monitoring" as outlined in the City's Shoreline Protection Guidelines.

¹ Guidelines for Shoreline Protection, City of Laguna Beach, 1988

Policies

- 6A. Prohibit the construction of buildings and other man-made structures on the sandy portion of the beach, unless necessary for public health and safety.**
- 6B. Review any development application for shoreline construction with respect to the criteria contained in the Guidelines for Shoreline Protection, including the effects of beach encroachment, wave reflection, reduction in seacliff sand contribution and aesthetic criteria.**
- 6C. Prohibit shoreline protective devices which will materially and adversely affect the sand supply or cause an adverse impact to shoreline processes, unless the situation is one in which there is evidence that the existing structure(s) may be in eminent danger from erosion and is designed to mitigate adverse impacts on local shoreline sand supply, and unless all reasonable alternatives have been explored.**
- 6D. Enforce building setback standards on local beaches to prevent exposure of structures to large sea waves of seismic or storm origin.**
- 6E. Prevent shoreline development which would place structures in danger of wave attack or degrade natural means of shoreline protection.**
- 6F. Ensure that storm water and drainage are contained, controlled and discharged in an appropriate manner.**
- 6G. Explore possibilities for beach or sand replenishment as an alternative to the construction of hard shoreline protection devices.**
- 6H. Consider the impacts of flood control improvements on sand replenishment of the beach.**
- 6I. Require damaged shoreline protection devices to be consistent with prevailing zoning regulations and general plan policies.**

IMPLEMENTATION

The policies of Safety Element of the General Plan establish the actions and requirements necessary to direct safety-related decisions in the City. It is recognized that the implementation of the policies in this document may already be underway or may evolve dependent upon City staffing levels, economic conditions and manmade or natural physical events. The time-frame objectives delineated in this section are goals for actions to be accomplished over the next three years. This section also identifies actions that need to be undertaken on an ongoing basis. The time-frames are based on a snapshot of the community values, politics and conditions at a particular moment in time. Since these factors are continually in flux, the City must continually monitor the relevance of the Safety Element policies and their implementation progress, so that the main goal of protecting the public's health and safety over time is maintained and improved. The City Council recognizes this charge and will annually review the safety objectives achieved during the preceding year and will set new safety objectives for the next year, based upon changing conditions, new information and revised City policies and priorities.

Many of the implementation actions will require additional staffing and/or additional funding for their successful and timely completion. Funding constraints beyond the City's control may make it difficult or impossible to allocate funds for the necessary staff, equipment or consulting services necessary to complete some of the items. It is recognized that the necessary staff, equipment and consultants are dependent upon an annual appropriation by the City Council as part of the annual budget process and annual review and prioritization of safety objectives. It is also recognized that the implementation measures identified in this Safety Element will realize substantial cost benefits in the preparation for disasters and their avoidance or impacts.

Some of the implementation measures require capital improvement projects to be constructed. These projects may require a review according to the provisions of the California Environmental Quality Act, and environmental degradation and grading shall be minimized to the greatest extent possible. However, it is also likely that some of these projects, such as emergency access improvements, may prevent the literal consistency with all of the pertinent General Plan and environmental protection policies, thereby necessitating a careful balancing of competing objectives. Public health and safety should be of primary concern when prioritizing these competing objectives.

The City's Safety Element includes actions which range from measures necessary to insure consistency between the City's general plan and federal, state and local regulations to those actions required to fulfill the policies in the plan. These actions have been divided into four time frames with the designation the primary department(s) responsible for their implementation.

Within one year of adoption of this Safety Element, these City Departments are primarily responsible for the following:

Fire Department

- Appointing a full-time Emergency Management Coordinator.
- Updating the Emergency Services Plan, incorporating a citizen response model, evacuation plans, emergency aid, a comprehensive communications component and a coordination program with other local government agencies, schools, hospitals and utility companies.
- Developing an informational hazardous material and disaster preparedness educational program for individual households and neighborhood associations.
- Identifying utility facilities in hazard areas for relocation or undergrounding.
- Preparing a pamphlet regarding fire safety as it relates to landscaping installation and maintenance.
- Evaluating the relocation of equipment and services for emergency purposes.
- Adopt a Water Quality Control Ordinance which replaces Title 16 of the Municipal Code.

Municipal Services

- Investigating the establishment of interim holding or drop-off centers for hazardous materials.
- Evaluating the location of all public facilities in relation to hazard areas for possible relocation.
- Establishing and maintaining critical no parking/tow away zones for public safety.

Within two years of adoption of this Safety Element, these City Departments are primarily responsible for the following:

Fire Department

- Establishing an Emergency Operations Center, including the acquisition of a mobile Incident Command Support vehicle.
- Undertaking a comprehensive emergency access and evacuation evaluation program and implementing its recommendations.
- Developing a funding mechanism for the fuel modification program.
- Coordinating local emergency service facilities with utility companies.
- Identifying the effects of the most probable seismic event on the City's infrastructure.
- Developing an education program promoting emergency response preparedness, especially for earthquake survivability, and home retrofitting and adequate anchoring.
- Preparing an information pamphlet on flood hazards and protection measures.
- Preparing and implementing an early warning system of wildfire dangers with the County and adjacent communities.
- Developing a perimeter fire prevention system with adjacent cities and jurisdictions.

Within **three years** of adoption of the Safety Element, these City Departments are primarily responsible for the following:

Community Development Department

- Preparing a Geological Hazards Map of the entire City.

Municipal Services Department

- Updating the Master Plan of Drainage of the entire City into one plan, especially in regards to prioritization of projects.
- Preparing and adopting a Flood Control Plan for the Laguna Canyon Creek watershed providing for a minimum protection objective of 25 year flood through the use of flood water conveyances, retention and holding basin facilities.

Finally, the last part of the implementation section lists actions to be taken on an ongoing basis and include the following:

City Council

- Annually review the Safety Element objectives achieved during the preceding year and set the safety objectives for the next year, based upon changing conditions, new information, revised City policies and priorities and budget constraints.
- Ensure that adequate facilities and police and fire services are maintained to protect the citizens of Laguna Beach.
- Oppose offshore oil leasing.
- Monitor the conversion of El Toro Marine Corp Air Station and attempt to mitigate the impacts of future uses.

All City Departments

- Participate in emergency response exercises and operational support for the Emergency Operations Center.

Fire and Police Departments

- Maintain mutual aid arrangements and hold disaster preparedness exercises.

Fire Department

- Monitor local sources of toxic wastes.
- Encourage and support the use of alternatives to toxic materials.
- Implement appropriate emergency warning systems for any radioactive contamination episode from the San Onofre Nuclear Generating Station.
- Maintain the performance standard of an average total reflex time of seven minutes or less.
- Annually review and continually maintain and improve the City's fuel modification program.
- Encourage property owners to create defensible space surrounding their homes.

- Implement the appropriate recommendations of the Orange County Report of the Wildland/Urban Interface Task Force's recommendations.
- Work with the Water Districts to maintain an adequate supply of water, both for consumptive use and emergency fire-fighting supply.

Community Development Department

- Require that new streets have a minimum unobstructed width of 20 feet.
- Limit cul-de-sacs to 24 building sites and 750 feet in length.
- Require the undergrounding of utilities for new development.
- Require soils and geology reports based on subsurface explorations and their independent review for new development. Maintain these reports on file and index in the City's Geographic Information System. Restrict development where there is a geological unacceptable level of risk.
- Require supervision of a soils engineer for grading operations.
- Enforce bluff and hillside protection measures.
- Require erosion control measures for new development.
- Adopt the latest editions of the Uniform Building Code, especially in regards to earthquake standards and fire resistive construction.
- Prohibit the location of new essential facilities in geologically hazardous areas.
- Require the latest earthquake standards for new essential facilities.
- Require that new development next to the wildland interface to have fuel modification and fire resistive construction. Require private responsibility for the establishment and ongoing maintenance of these fuel modification areas.
- Encourage property owners to consider "fire-wise" planting surrounding their homes.
- Allow access roads, trails or fire roads within fuel modification areas where feasible.
- Maintain natural water courses as flood control channels whenever it is safe.
- Monitor the effects of inland development on the City's watershed and attempt to minimize their impacts.
- Prohibit the construction of structures on the sandy portion of the beach.
- Enforce building setback standards from beaches and bluffs.
- Require shoreline protection devices to comply with the adopted Guidelines for Shoreline Protection.

Municipal Services Department

- Ensure that new public facilities or major additions are designed and located to minimize or eliminate any potential hazard impacts.
- Promote and implement safe disposal of hazardous wastes.
- Facilitate effective response to hazardous materials emergencies.
- Facilitate the proper separation of sewer and storm drain systems through proper design, infrastructure upgrades and timely maintenance.
- Participate in the Aliso Water Management Agencies to improve water quality and to manage the watersheds.

- Provide for ongoing maintenance and inspections of all public drainage facilities and remind property owners to maintain private drainage structures.
- Maintain and improve the City's storm drainage infrastructure capacity. Ensure that storm water and drainage are contained, controlled and discharged in an appropriate manner.
- Eliminate or mitigate uncontrolled storm drain flow on hillsides or bluffs.
- Utilize only proven and effective erosion control methods after fire disasters.
- Develop, adopt and construct flood control plans. Minimize their environmental consequences.

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